HOW TO MAKE PHOTOGRAPHS.

A MANUAL FOR AMATEURS.

Published by
E. & H. T. ANTHONY & Co.
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Broadway, New York.

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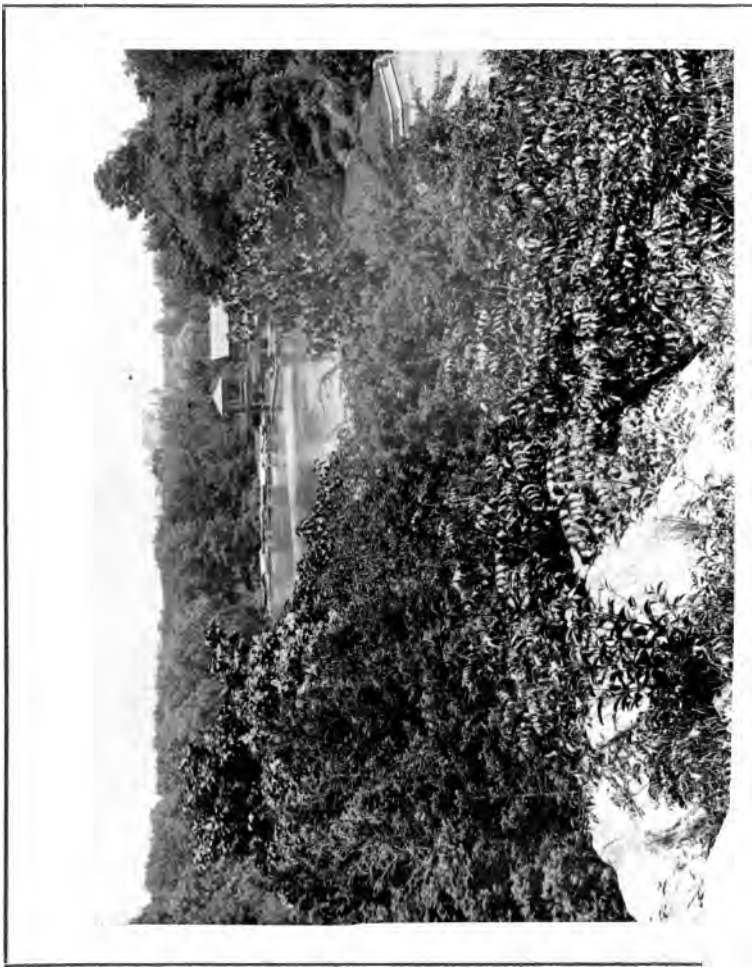
MADE WITH ONE OF ANTHONY'S



TEN DOLLAR EQUIPMENTS

HOW TO MAKE

PHOTOGRAPHS

A MANUAL FOR AMATEURS.

BY

T. C. ROCHE

EDITED BY H. T. ANTHONY

(*ILLUSTRATED.*)

WITH AN APPENDIX BY A. H. ELLIOTT, PH. D.

Associate Editor of Anthony's Photographic Bulletin.

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1886.

PREFACE.

The instruction imparted in this little book will be more readily understood by the general reader than is usually the case in works of the kind. The practice and formulæ given are the most approved, and have all been tested by ourselves.

Technicalities have been avoided, as far as practicable, and the various processes will be found plainly and briefly stated.

THE PUBLISHERS.

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TRADE MARK
STANDARD
EA
Established A.D. 1842
CHEMICALS


TRADE MARK
STANDARD
EA
Established
A.D. 1842.
CHEMICALS.

INTRODUCTION.

PHOTOGRAPHY has at length enlisted that public interest it really deserves, for it is found to be almost indispensable in all the arts and professions. Not only so, but the artist and the artisan, the professor and the student, the man of letters or of leisure, the matron or the maid may one and all derive infinite pleasure as well as profit from the practice of this fascinating pursuit.

Simplified by the introduction of the sensitive gelatino-bromide dry plates, it is now within the power of any one to become proficient at little expenditure of time or means. It is alike adapted to old and young, male and female; indeed many ladies have already become very expert and have openly declared in favor of it. The fact that neither hands nor clothing need now be soiled, as was so often the case with the old "wet" process, renders it extremely popular.

The burdensome paraphernalia of the past has been utterly discarded, the only *impedimenta* now required being seen in Fig. 1. This is a very important consideration, especially for outdoor photography, when the apparatus must necessarily

be borne to the spot where the subjects are. Fig. 2 represents the amateur at work, with tripod set up, and camera adjusted. Fig. 3 similarly illustrates a lady enthusiastically endeavoring to secure an instantaneous picture of her pet poodle.

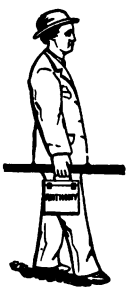


FIG. 1.

This hand-book is published for the purpose of aiding those who have had no previous experience in photography, so that by merely reading it the amateur may acquire all the necessary knowledge for the use of the apparatus and the management of the various chemical and other incidental manipulations.

FIG. 2.

It is considered inexpedient to include within the scope of these pages the mode of making the gelatino-bromide plates themselves; but few of those who may use them for any purpose would care to incur the expense and trouble involved in their preparation. Dr. Eder's work on the subject (costing $1) contains all the requisite instruction, both theroretical and practical. Sensitized albumen paper is also prepared on a large scale, and sold by all dealers in photographic materials; it is therefore quite unnecessary to go into the details of that manufacture. This practical information can be found in a work entitled the *Art and Practice of Silver Printing* (costing $1) and published by ourselves. Cer-

FIG. 3.

tainly no one having once used the sensitized paper furnished by our house will ever undertake to provide it for himself.

But the greatest achievement of all, perhaps, is the preparation of a sensitive printing paper with gelatino-bromide of silver, the same substance used for the negatives, with which any one can instantly print without the aid of the sun. This will be explained for the first time farther on.

The works above alluded to are handsomely bound in cloth. A cheaper edition in paper may be had, if preferred.

Should any one need a more extended list of apparatus and photographic materials than is herein contained, we shall be pleased to mail a copy of our complete catalogue.

E. & H. T. ANTHONY & CO.

CHAPTER I.

Preliminary.

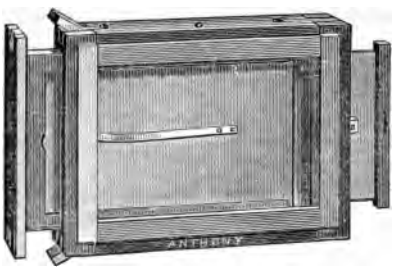
IN setting out to make photographic negatives there are various articles necessary to be procured, all of which are to be used in a certain order. Some of these articles are to be employed in obtaining the action of the desired object upon the dry plate, and the others are to be used for developing and rendering visible such action.

The former are—

1. The dry plate.
2. The lens, camera, and focussing cloth.
3. The shield for holding the plate, frequently also called a plate-holder.
4. The camera stand.
5. A room adapted for transferring the plates, so that no injurious light shall at any time fall upon them. As an adjunct to this room, a light.
6. A proper lamp.

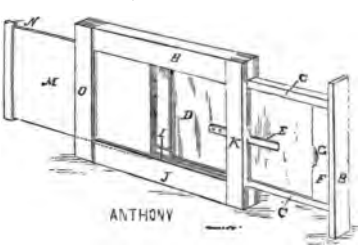
These being all provided and in readiness, the first thing to do is to place the sensitive plates in the plate-holders, with-

in which they can be perfectly shielded from the light. As this cannot be done in the dark, a suitable lamp is lit and



these are then taken into the dark room. The package containing the dry plates is then opened and a plate slid into each compartment of the shields. Upon examining the plates, as taken out of the box, they will be found to have a mat surface and a bright one. The mat surface is the one upon which the negative must be made, and should be placed in the plate-carrier so that it faces outward.

A plate-holder or shield consists of three distinct parts, the body or frame, the two slides—one on each side of the body—and the plate-carrier, which occupies the middle interior space. The plate-carrier holds two plates, and when the latter have been put into it, as above described, it is pushed into the central interior space of the frame and the little brass straps, or loops, are turned into place. It is unnecessary to withdraw the slides or shutters except when exposing the plate, as hereafter mentioned.

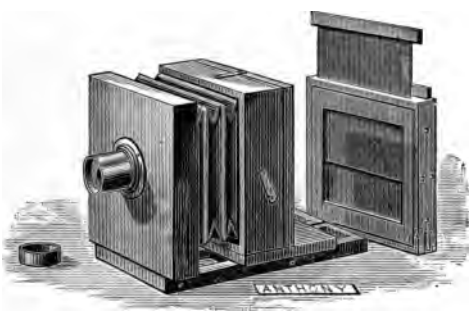


After putting the plates in the shields the remaining ones should be carefully covered up to protect them from the light.

These shields not only serve to hold the plates, but they are arranged to fit on the camera in a certain position.

The camera, in conjunction with the lens, the ground glass (on which the focus is obtained) and focussing cloth, is the instrument by which the image of the object to be taken is conveyed to the sensitive plate.

The lens is attached to the front of the camera, and has upon it a little leather cap, and while this cap is on no light

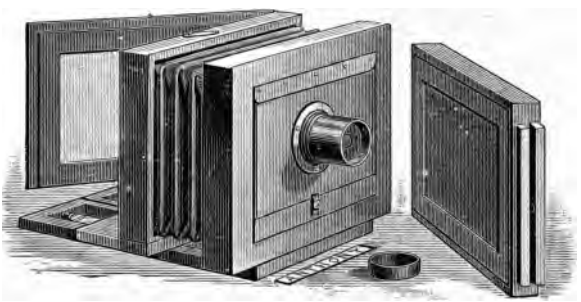


CAMERA AND LENS WITH $9 EQUIPMENT.

from the lens can pass into the camera. To the back of the camera, which is adjustable as to the distance from the front, is applied the ground glass, by means of which the proper position of the sensitive plate contained in the shield is determined. When thus fixed this focussing glass is removed, and the shield is put into its place, the surface of the sensitive plate now occupying exactly the position of the surface of the ground glass before its removal. At this moment all is dark inside of the camera, and inside of the plate shield—the slide

or door of the shield not being withdrawn and the leather cap still covering the lens.

To make the exposure of the plate first draw out entirely the slide or door of the shield nearest the lens, and then, when you have your watch ready to indicate the number of seconds to be given, the leather cap is very gently lifted off the light



CAMERA AND LENS WITH $10 EQUIPMENT.

allowed to pass through to the plate during the proper interval of exposure, and the cap is replaced upon the front of the lens; then, holding the slide exactly parallel with the shield, push it entirely back into the groove.

This plate is now ready for the next operation, the development, which is done in the dark room. As there is another plate, however, in the other compartment of the shield, care must be taken to mark the one already exposed, so that it cannot be used a second time.

It remains now to describe in detail the method of applying the camera, for the purpose of getting it into position and securing the image. As this instrument must be supported at

a height convenient for the eye of the operator, a tripod or three-legged stand is provided for that purpose, the former being secured to it by means of a screw, which passes through the top of the stand into its counterpart in the bottom of the bed. The tripod is then set by so separating its feet as to bring the camera into a horizontal position.

The subject must now be focussed. It may be observed that in outfits of the better class, for the purpose of portability, a portion of the bed of the camera is folded. This is brought down to a horizontal position and kept firm by means of a long screw, which passes through the adjoining rails of the bed.

The adjustable, rear part of the camera carrying the ground glass can now be moved, first to a mark which indicates very nearly its proper place, and there be fastened by a short upright binding screw running in a groove on the middle rail of the bed. The final, accurate focussing must be done by throwing the black cloth over the rear part of the camera, thus shutting off all outside light from the focussing glass

Now, by putting the head under this cloth and at the same time uncapping the lens, any lack of sharpness in the picture may be seen and corrected by turning the horizontal adjusting screw.

As soon as this is accomplished turn the camera on its stand until the exact limits of the desired subject are depicted on the ground glass, tighten the screw which attaches the camera to the top of the stand, put the cap on the lens and you are ready for applying the plate shield.

The lens is a part of the apparatus with which the owner has nothing to do except to keep it clean, protecting it from dust and from being scratched. Is is provided with diaphragms, the use of which will be treated of under the head of exposure.

Exposure.

By exposure is meant the interval between the uncapping and recapping of the lens, as above described, and during which the sensitive surface of the plate in the shield has been *exposed* to the action of the light. This necessary act is attended with more uncertainty, and requires more judgment and experience, than any other in the course of taking a negative. One picture may be taken in the fifth part of a second, while another may require an hour.

The exposure is controlled by two different causes, viz., the strength of the light and the area of aperture in the diaphragm used. These diaphragms are small plates of iron or brass, all of the same external size, but having central circular holes of different sizes. They are usually contained in a leather case, and fit in a slit in the brass mounting of the

lens, and the quantity of light that passes through in a given time is necessarily dependent upon the area of this hole or opening. As the effect upon the plate depends on the quantity of light falling upon it in a given time, the exposure must therefore be much shorter when that light is allowed to pass through a large opening than when it comes through a very small one. Consequently, to obtain upon the plate with a small opening the same effect as is produced in a given time by the larger one, the exposure with the former opening must be proportionally prolonged.

After having ascertained by experience about the time of exposure required by any one opening with a given lens, that for any other opening is a matter of calculation, and will be shown hereafter. As most of the pictures will be of landscapes (we will assume by one of our $10 outfits), a well lighted landscape taken with a diaphragm having an opening of one-quarter of an inch in diameter will require an exposure of one and a half to two seconds. This furnishes a starting-point for beginners to go by.

Plates that have been exposed in the camera, but not yet subjected to the subsequent operations of developing the latent image nor the final one of fixing (afterwards to be described), must be as carefully protected against the action of ordinary sunlight, gaslight or candlelight, as those that have not.

By a well lighted landscape above is meant a sunlit scene, and the time of exposure (say) two seconds, is sufficient for a one-quarter inch diaphragm. Now if we desire to work more quickly and use a one-half inch diaphragm, the neces-

sary exposure would be in the inverse proportion of their squares. As the area of the one-half inch opening is four times that of the one-quarter inch, the exposure with the one-quarter inch opening will be one-fourth that of the latter, or, in other words, one-half of a second, and *vice versa.* As a defect in the time of exposure may be remedied in the development, extreme accuracy in these calculations is not absolutely necessary; with a little practice and judgment one will get over this difficulty.

As the exposure depends upon the strength of the light primarily, it is proper to mention in this connection that the strength of *sunlight* varies very much according to the season of the year, being the greatest in midsummer and the least in midwinter; and these lights are occasionally modified, in summer by being very much *reduced* by a yellow tinge in the atmosphere, and *increased* by a covering of light, fleecy clouds, and in winter it is augmented by the presence of snow on the ground.

The best pictures are not produced by exposing during the middle of the day; in the morning or afternoon, when the rays of the sun are more removed from the perpendicular, the most pleasing effects are secured.

The Development.

The exposure has no *visible* effect on the negative, but its action can be rendered visible by the subsequent application of a liquid called a developer. This brings us to the recapitulation of the articles required for that purpose. The other articles have been used in the light; these, on the

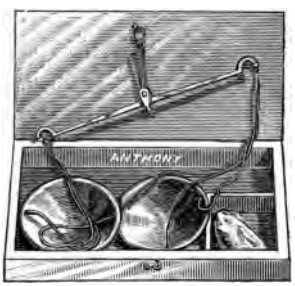
other hand, must all be used in the dark room ; and it should be understood that the shields containing the exposed plates must in no case be opened until they are safely lodged in the dark room for the purpose of developing.

The articles to be provided are as follows :

1. Japanned iron dishes, or other trays, according to size of plate.
2. Glass graduates.
3. Glass funnels.
4. Glass stirring rods.
5. Litmus paper.
6. Filtering paper.
7. Bottle for containing saturated solution of oxalate of potash.
8. Bottle for containing saturated solution of sulphate of iron.
9. Bottle for containing solution of bromide of potassium, twelve grains to one ounce of water.
10. Bottle for containing saturated solution of common alum.
11. Bottle for containing solution of hyposulphite of soda, one ounce of hyposulphite to eight ounces of water.
12. A pair of scales weighing grains, and a larger one for ounces and pounds.

The development is effected by mixing together the oxalate of potash, the protosulphate of iron and the bromide solution, in different proportions. For that purpose pour into one graduate three fluid ounces of the oxalate solution, and into

another one fluid ounce of the iron solution, and into another two drams of the bromide solution. Place these on a convenient table in the dark room. Into the graduate containing the oxalate solution pour two drams of the iron solution, and five or ten drops of the bromide solution, and mix thoroughly.



TO WEIGH GRAINS.

This constitutes the *developer*. The door of the dark room must now be closed, and one of the japanned trays placed on the table. Take one of the exposed plates out of a shield, place it face upwards in the tray and immediately pour the developer all over it rapidly, so as to avoid making any stains or streaks. Keep the developer moving over the face of the plate by rocking the tray.

In from twenty to thirty seconds (if the exposure has been right) dark spots will begin to appear on the surface. These show where the light has acted most strongly on the plate, and indicate what are called the *high lights* of the picture. By allowing the developer to act longer the high lights will become darker, and the other portions of the picture will begin to show themselves by a gradual blackening.

In case this gradual action of the developer appears to be arrested and the surface of the plate remains partly black and partly light-colored, pour off the developer into its graduate, add to it one more dram of the iron solution and again pour it upon the plate. This will renew the blackening, and it

the exposure has been correct will probably be sufficient to complete the development, which is known by seeing the black veil just obscuring the parts that had remained light-colored. Now pour the developer off, take the plate out of the tray and look at the back of it. If the development can be distinctly observed on the back it may be considered finished. The negative must now be well washed and then put into the fixing bath.

This developer may be used for another plate, provided it is employed immediately. If no other plate is ready it can be thrown away, unless it is kept and again used in the manner hereafter described.

The fixing bath is the solution of hyposulphite of soda, which is poured into a tray. The plate being placed in it face upwards is left, with occasional rocking, until all the white coating on it is dissolved. This is indicated when, by looking at the back of the plate, no trace of the coating is seen.

A very copious washing in cold water must now be given, in order to get rid of the hyposulphite of soda. The negative is now finished, and can be taken out into the light and put away in any convenient place to drain and dry.

It may as well be observed here that the gelatine which forms the coating of the plate is very soluble in warm water; all the solutions above mentioned should be cool, not over 60 deg. Fahr. In cold weather the water used is generally cold enough, but during the summer it must be artificially cooled. As an additional precaution in warm weather, the plate after development should be allowed to lie a few minutes in a saturated solution of alum before being placed in

the fixing bath. The alum solution need not be washed off.

The remarks in the above paragraph have no reference to the new "TROPICAL DRY PLATES," manufactured for us, that may be submitted to solutions at any temperature without injury, and used in any climate.

Having thus described in the fewest words and in the most simple manner the process of making a negative, the beginner's attention will now be called to various details, upon the due understanding of which his success as a proficient dry plate worker will depend.

CHAPTER II.

Photographic Lenses.

LENSES are made in various styles, and combined in numerous forms to produce different effects. In selecting these the purchaser should carefully examine the different kinds, and decide in favor of the one that comes nearest to his (or her) requirements, for there is no single variety to be had that will answer absolutely for all purposes; indeed it is improbable that such will ever be made.

NO. 1 DRY PLATE LENS.

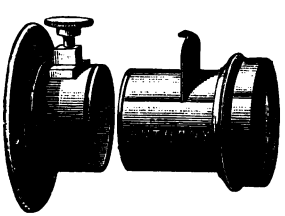
The simplest form is what is termed a "single combination." It appears to be but one lens only, though in reality it is two sealed together. One is of flint glass, the other of crown. A judicious or proper combination of the two "achromatizes" them. This "single achromatic lens" is suited for general landscape work, but not for architectural pictures, as it does not yield *rectilinear* lines, *i. e.*, a picture of a house, where the latter nearly covers the plate, would show

the sides of the building *curved* or "barrel-shaped;" on the contrary, reversing the lens and using it in that position on the same subject would render the outlines "mortar-shaped," *i. e.*, curved inward as they approach the centre. Hence, to produce strictly rectilinear pictures a combination of the two above-stated results must be resorted to, giving what is termed a "double achromatic combination."

NO 2. DRY PLATE LENS.

When a lens of single combination is selected, to cover the plate sharply a small opening or diaphragm must be used, the illuminating principle of a lens being the same as that of a window, *i. e.*, the larger the opening the greater the quantity of light admitted. When very rapid exposures are desired, a lens must be used that needs no diaphragms, and at the same time covers the plate sharply. It requires a certain degree of light to act sufficiently on the sensitized plate to produce the proper effects, and, although this period of exposure is reduced to a minimum by the advent of such quick-working dry plates as "Stanley's Lightning," with which almost marvellous results have been obtained, the lens must be chosen that will best suit the operation.

4 x 5 RAPID DRY PLATE LENS.



4 x 5 RAPID DRY PLATE LENS.

In enumerating them, we shall confine ourselves to a few only of the different styles, those that in our practical working have proven to be best adapted to cover every want. These can be placed under three general headings, beginning with—

I. Ordinary Single Achromatic Lenses.

Suited for general landscape work and buildings, where the latter do not take too prominent a position in the picture. The wood-cuts nicely illustrate the appearance of the lenses,

THE E. A. VIEW LENS.

which are made expressly for the purpose, and are all that could be desired. In a good, bright sunlight, they will not require more than from three to five seconds, to admit of a full exposure.

Anthony's No. 1 Dry Plate Lens is a single achromatic combination, covering sharply a plate of 4 x 5 inches, and furnished singly or in matched pairs for stereoscopic work.

Anthony's No. 2 Dry Plate Lens is made in the same style as No. 1, but larger, covering a plate of 5 x 8 inches.

The E. A. View Lens is a single achromatic, with rack and pinion for focussing, and extra diaphragms in the front hood.

II. Ordinary Double Combination Lenses.

The remarkable "Platyscope Lens" is a double achromatic combination for making architectural, indoor, *instantaneous* views, groups, and, in fact, any style of view from ordinary dis-

tances. Each lens has a complete set of diaphragms in a leather case. (See wood-cut below.)

Anthony's 4 x 5 Rapid Dry Plate Lens, has a double achromatic combination for making instantaneous views and por-

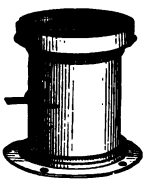
traits, groups, etc. The lens is focussed with the full opening, the flange being removable for the insertion of the diaphragm. (There is no other size of this style.)

III. Dallmeyer's Combination Lenses.

These celebrated lenses are made by the most eminent optician in the world, and have proved to be *without equals.* They cost correspondingly, but to any one desirous of producing the finest results, that are only attainable by using the very best of instruments, the quality of the lens should be a matter of serious consideration.

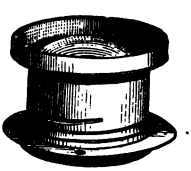
The fact that they are in daily use by almost every professional photographer throughout the globe who claims to produce good work should be sufficient proof that their merits are not overrated. We shall not speak of the long line of single and double achromatic combinations, but merely of

two of them, that will be found excellent and ample for any work the amateur may wish to perform. They are both known as *Rectilinear* lenses, and give mathematically correct lines over the entire plate.


ANTHONY

The Dallmeyer Rapid Rectilinear lens is suited for instantaneous views, architectural subjects, portraits, groups, copies of maps, drawings, dimly lighted interiors, etc., etc., covering the plate more sharply and working more quickly than any other lens known. Each one has a full set of Waterhouse diaphragms in morocco case.

Dallmeyer's Wide Angle Rectilinear lens embraces an exceedingly wide angle, and is indispensable for pictures of buildings, rooms, etc., where but a very short distance from the object can be obtained. As only small diaphragms can be used, the latter are all made on a circular revolving plate. This lens can also be used for landscapes, by removing the front lens and *using the rear combination alone.* When thus employed, the field will be similar to that of an ordinary landscape lens of the same focus.


ANTHONY

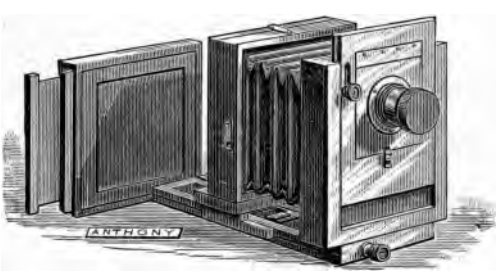
With one each of the "Rapid" and "Wide Angle" Dallmeyer Rectilinear lenses, the amateur or artist can feel fully equipped for any views he may wish to photograph of still or active life. Practically, he will be possessed of three of the most useful lenses for general photography ever made.

Care of Lenses.

When not in use the lens should always be kept covered with its cap. If dusty, clean the glass with some old, soft linen or chamois leather, but *never with cotton or silk.* Ignorance of this fact has often ruined many a fine lens. The flange or collar of the lens tube is fastened to the front part, or the front board of the camera, and the tube containing the lens either slides or screws into this collar. It is generally removed when the camera is packed up, rolled in tissue paper, and, if small, placed inside the body of the camera for safe keeping and carriage.

Cameras.

The camera, we have seen, is so arranged as to exclude all rays of light from falling upon the sensitized plate, except



CAMERA AND LENS WITH NO. 4 EQUIPMENT.

those that come through the lens. The nearer we approach the object to be photographed, the greater must be the distance between the lens and the sensitized plate; and to be able to effect this it is made in two parts, the front one being attached solidly to the bed, and the rear part admitting of

being moved closer to or farther from the front, as required. The wood to which the lens is attached is sometimes solid, *i. e.*, an integral part of the camera, or the lens may be fastened to what is termed a "front board," which fits in an opening cut to receive it. By this latter arrangement lenses of different foci, mounted on interchangeable panels, may be used as necessary to obtain the desired result. The rear part of the camera is held in position by a milled-headed nut, (or focussing screw). Between front and rear is placed a bellows, made either of linen, rubber cloth or leather, which allows the rear part to be moved forward and back readily. The ground glass at the back rests on dowel pins, and is held in position at the top by a hook. In our Novel Camera, the ground glass frame is made smaller than the camera, and is held against it by hooks catching on pins inserted in the frame.

Folding Bed.

Some cameras (especially our Nos. 4, 5, 6, 7 and 8,) are made with what are termed folding beds. The bed is then made in two parts hinged together, and when packed for transportation the projecting part is folded up against the ground glass, serving as a protection to it, and admitting of a large camera being packed in small compass. When in use, a screw fastens these by bolting the two sections of the bed together; when not in use the screw is carried in one of the cross rails.

Focussing Screw and Rack.

This is an arrangement for focussing the camera and holding it in position. The button or milled-headed nut, as on

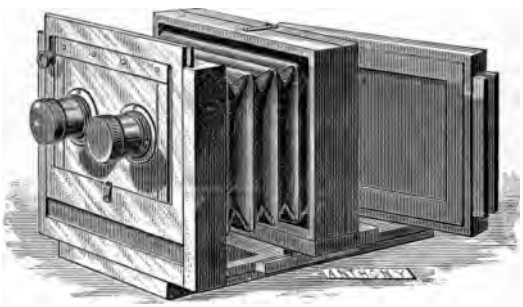
our No. 1, 2 and 3 cameras are thereby dispensed with. The focussing screw is placed in the slot in the centre rail of the bed, and the body of it is held at any desired point by a bolt which passes through it, the head of the bolt running in the transverse slot; a round nut on the bolt holds it firmly to the bed. The screw is placed on the front of this body, between its shoulders, a groove being turned in it to fit these, and the thread of the screw is inserted in a plate attached to the rear or sliding part of the camera. By turning this about half way in, unfastening the bolt, and grasping the body of the focussing screw with the fingers, the rear part of the camera is moved until very nearly the proper focus is obtained. Then fasten the body firmly, and, by turning the focussing screw by its milled head, the focus can be adjusted very finely. Great attention must be paid to this, and it should be done slowly, for on it will depend much of one's success. A picture out of focus looks misty and blurred.

If a camera with focussing rack and folding bed be used, and it is desired to pack up before removing the screw or bolt that holds the bed straight, see that the rack be run in as far as possible, and does not project over the joint in the bed. Want of this precaution has often bent and ruined the focussing screw.

Rising Front.

Our Nos. 4, 5 and 6 cameras have what is called a "rising front." This is an extra front to the entire face of the camera, and admits of raising or lowering the lens. Should you be on a hill and wish to make a view of the valley before you, it

would appear on the ground glass to be nearly all sky. To take in more of the scene lower the lens, without tilting the



CAMERA AND LENS WITH NO. 5 EQUIPMENT.

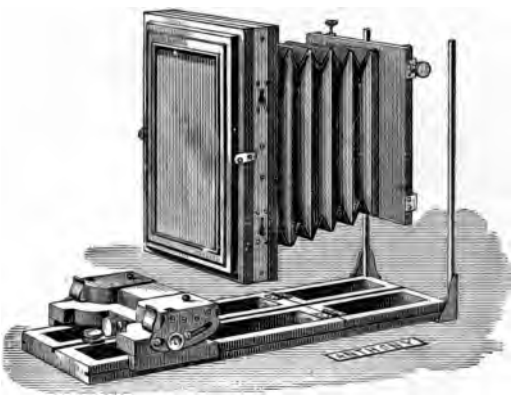
camera, which must be kept as nearly horizontal as possible. By means of a sliding front you can thus lower the lens to include the desired view. If in a valley, desiring to photograph the surrounding hills, you should raise the front correspondingly.

Novel Cameras.

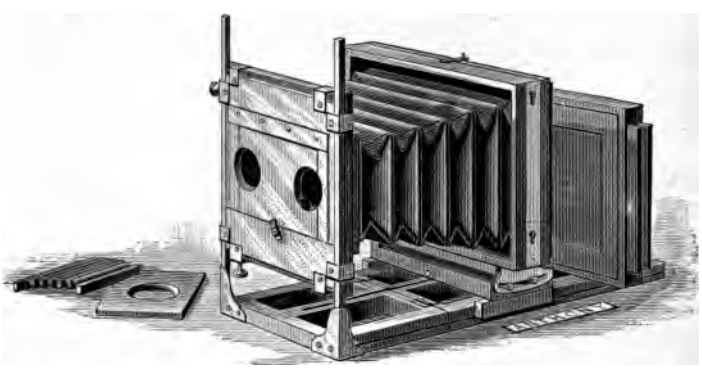
These differ widely from any other produced in our market, and possess qualities that render them superior to all others. The body of the camera can readily be detached from the bed (the latter remaining on the tripod) and replaced in either position, so as to present the plate either vertically or horizontally. The method employed to produce this result will be found very satisfactory.

The 5 x 8, 6½ x 8½ and 8 x 10 include the partition and an extra front board for stereoscopic views.

Tne rear may be moved forward or backward in the same way as with the ordinary camera, so that all parts of the sub-



ject may be *clearly defined* on the ground glass, the sharpness or delineation of it depending entirely on the degree



of accuracy with which the focus has been obtained. Should you wish to include more of the view in the picture than is

shown on the ground glass, move the instrument further away and focus again, until you obtain the desired result. The ground side of the focussing glass should always face inward.

Plate-Holders or Shields.

Our new, patented shield or plate-holder, styled the "PERFECT," differs from any other in the manner of inserting the plates and securing them in position.

This shield is described on page 11. In addition to the metallic loops which secure the plate-carrier within the shield, the slides are prevented from being accidentally opened by means of a spring and catch, which work automatically. When the plates have been slid into place in the carrier they

should be cleansed from dust with a camel's-hair brush, as above, which is called a blender.

One great advantage of our patent shield is that it can be used for exposing plates of various sizes, as kits or inner frames of smaller size holding such plates can be slipped into the grooves. Thus an 8 x 10 shield can be used for any of the following plates (say) 6½ x 8½, 5 x 8, 5 x 7, 4 x 5, etc., as desired. We keep a line of these kits in stock of all the usual sizes.

Tripods.

The tops of the tripods, whether triangular or round, all have pins or projections on which the sockets in the top of the legs rest, when the latter are unfolded and the apparatus set up. Figures 2 and 3 on page 8 show the position of the camera and tripod ready for focussing. A brass screw, that passes through the top from beneath and enters a plate in the bottom of the camera bed, securely holds the camera to the tripod, as previously stated.

It is often the case that the view most desired must be made from a position where the ground is very uneven. As it has been found almost impossible, in some instances, to set the camera level, we have introduced what is called the telescopic tripod, any or all of the legs of which can be lengthened or shortened at pleasure, thus rendering it possible to make many views that otherwise would be very difficult to obtain.

Focussing Cloth.

To clearly discern the image on the ground glass, the head and rear part of the camera should be covered with an opaque piece of cloth or dark velvet; about 2 x 3 feet is a very good size. This is used only when focussing, and screens the light between the vision and the ground glass, enabling one to see clearly that the focus is correctly drawn. This may be made

purposely, or improvised in case of necessity from a garment. A piece of ordinary black muslin will suffice, if nothing else is convenient, or a cardboard hood, to fold flat against the camera, may be substituted.

Focussing Lens.

Another very convenient and, in some cases, necessary article for the amateur is a focussing lens. With this little instrument (which, by the way, may be easily carried in the pocket) one is enabled to see with far more clearness when the lesser objects in the picture are depicted distinctly on the ground glass. The lens is adjustable, so as to accommodate the vision of different persons, and is always held parallel to the ground glass by its three standards or feet. Necessarily, when once adjusted for a particular individual, the focus need not again be changed.

CHAPTER III.

IN the preceding chapter we have illustrated and described only the apparatus essential for the single act of procuring the latent image on the sensitive plate. The present one will include those articles provided for the development of that image, or impression, and others incidentally useful in the subsequent operations at home.

On a previous page, under the head of *The Development*, the following are enumerated :

Japanned Iron Dishes or Trays.

These are specially made for the purpose, of good strong sheet iron, afterwards covered with a coating of black japan varnish. They can be had in sizes adapted to all the different dimensions of dry plates manufactured; are quite inexpensive, and at the same time very strong. The glass and porcclain vcsscls formerly used were much more

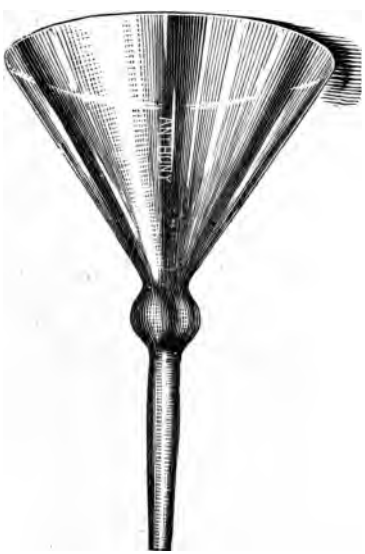
costly and exceedingly fragile. Occasionally, however, from inattention or frequent use they become oxidized, and therefore more or less unsightly and unserviceable. To correct this we prepare an excellent black varnish, which may be applied, after removing the loose scales or rust and cleansing, by flowing it on and pouring off the excess, or by means of a brush. The tray should be warmed before the application and afterwards dried at a temperature of about 120 deg. Fahrenheit.

Glass Graduates.

These may be had in many sizes, from a minim to a quart. They are not only useful in measuring solutions, but are found convenient in developing the negatives, having lips which facilitate the act of pouring. Three or four of varying capacity, according to the dimension of the plate in hand, will be sufficient. The annexed wood-cut represents a superior one we have lately introduced, in which the divisions are moulded in the glass, and are therefore much more accurate and reliable than those ordinarily furnished. Due care must always be given to cleanliness. Before use, wash and rinse thoroughly.

Combined Funnel and Filter.

Like the foregoing, these are made in several sizes. The Combined Funnel and Filter, can be had in pints quarts or half gallons, and is of greatly improved form, the bulb admitting the pledget of prepared cotton through which the solutions percolate freely, unlike the ordinary funnel, wherein the cotton is apt to be compressed too tightly. The prices are not excessive.



Glass Funnels and Graduates.

The ordinary glass funnel without bulb, and the plain blown glass graduates may also serve. They possess, at least, the merit of cheapness; are easily kept clean and free from chemical contamination.

Anthony's Developing Bottle.

The object in devising this vessel may be stated in a single word—economy. Formerly the developing solution, from the fact of its deterioration when exposed to the atmosphere, was always made afresh, resulting in no inconsiderable loss. It

will be seen that the bottle—an ordinary narrow-mouthed one—is *perforated near the base* and a piece of rubber tubing inserted, the opposite end of which passes through the cork.

Now after the developer is poured into the bottle a small quantity of oil may be added, which, being lighter than the solution, will rise to the top, thus protecting it from the action of the atmosphere. The tubing, of course, admits of drawing off the developer from the bottom. After use, the solution can be returned to the bottle by way of the mouth; the oil will always rise to the surface, nd exert no injurious chemical action.

Negative or Drying Rack.

This little rack or stand, which folds compactly if so desired, although not actually indispensable in the dark room, will prove quite serviceable whenever a number of negatives are to be developed. A reference to the wood-cut will clearly suggest its construction and its use. The corrugations safely separate the plates in the act of drying, and receive them until they are stored away in—

The Negative Box.

This also explains itself. The inside, it will be seen, is provided with grooves, into which the negatives may slide.

In some the plates lie lengthwise, in others across the box. Its corners are nicely rounded and the outside varnished. The smaller sizes usually hold twenty-four negatives. Stout brown paper envelopes, known as negative preservers, are also obtainable, on which are printed a form to record the No., subject or remarks. When the latter are used the box may be dispensed with, and the negatives laid on end or piled one above another on an ordinary shelf. If neither are at hand, simply wrapping them separately in paper will be a protection.

Dark Room and Lamp.

By a *dark room* is meant an apartment into which, when the door is shut, not a ray of light penetrates either by crevice or entrance. To test the room go into it, shut the door and remain a quarter of an hour. If at the expiration of that time no trace of outside light can be seen, the room may be considered all right. If an opening admitting light is found, it must be effectually stopped by any convenient method. The dark room must necessarily be supplied with water and sufficient shelving.

Working entirely by night will render a specially arranged dark room unnecessary, but in either case a proper light will be required.

GAS BURNER.

As certain colors have the quality of more or less absorbing the photographically active components of ordinary white light, whether that of day or that produced by combustion, and as a dark ruby had been found very efficient, ruby globes or chimneys for lamps or gas jets are provided, which afford sufficient light to see by without danger to the plates exposed to it.

In these lamps it will be seen that both the upward and downward radiations from the yellow flame are intercepted. The chimneys are made of what is technically known as copper-flashed glass, which is the only one that may be relied on.

Ruby sheet glass and non-actinic paper can be procured to modify the light in rooms lit from the outside.

OIL LAMP.

Anthony's Perfect Dry Plate Lantern.

Amateur photographers have frequently expressed a desire for a compact, safe, and simply constructed lantern for dry plate

work. This one fulfills all of these conditions, being not only as convenient and compact as that above described,

but possessing the additional advantage of almost perfect immunity from breakage of chimney, and consequent protection against fire.

Each of its parts, it will be seen, are separable, and all are quickly and easily adjusted. There are no hinges to become dislocated nor wire armholes to break. It is easily lighted and extinguished; the chimney will never crack; it requires but little care to keep clean; it can never get out of order; it takes but little oil and affords a good light.

Carbutt's Multum in Parvo Dry Plate Lantern.

An excellent substitute for the above, though more costly, is Carbutt's *Multum in Parvo* Lantern. The following are some of the advantages claimed for it: It saves your eyesight. It is simple and easy to manage; nothing complicated, yet has three separate and distinct forms of light. It is adapted for the use of either oil or gas; is about nine inches square by fourteen high, with eight by ten deep ruby glass in front. Each lantern is provided with a coal-oil lamp, with improved patent burner, and silvered reflector, which

may be revolved in any direction and operated from the outside. By removing the revolving lamp bed, a hole will be found through which a gas burner can be introduced.

It can be used for seven or more different operations in photography, several of which have never been combined in any one lantern, to wit:

Lantern arranged for making positives by contact.

1. A safe light for the preparation of gelatino-bromide emulsion.

2. A safe light for the coating of gelatino-bromide plates.

3. A safe light for developing the most sensitive plates; while for preparing developer or doing other work the room can be instantly flooded with white light, and as quickly changed to the red, giving abundance of light by which to develope the largest sized plates used. The adjustable hood effectually shields the eyes from the glare of the red light, a matter of the greatest importance to those having a large

number of negatives to develope, or other work to perform necessitating red light.

4. An opal light by which to examine negatives or positives after fixing, enabling the operator to judge of their quality, thereby avoiding the necessity of leaving the dark room in search of white light.

5. A clear transparent light for making positives on glass

Lantern arranged for developing, and after fixing, examining negatives by opal light.

(gelatino-bromide); this feature is a valuable one; any one can materially add to his pleasure by making these most beautiful products of photography.

6. The making of enlarged negatives from gelatine positives, placed in front of the opal light.

7. The making of photo-micrographs with the clear, transparent light, which can readily be accomplished with the gelatino-bromide plate and the microscope.

8. By the adjustment of condensers and holder for slides and objective in front of the clear light, a very effective magic lantern is formed.

Anthony's Dry Plate Safety Box.

In outward appearance this resembles an ordinary negative box, though not so deep; but within, instead of grooves, it has a close-fitting cover lined with black velvet, so as to guard the plates against any possible intrusion of light. These of any size up to 8 x 10 may be removed from the original packages, and safely kept in this box until transferred to the plate-holder.

Plates.

Throughout this essay, when plates are mentioned, it must be understood that the Stanley Plates, sold by E. & H. T. Anthony & Co. and their customers, are alone referred to. These are called "Stanley's Lightning Plates," and are the most rapid plate yet made. They can be used for landscapes, copying, taking negatives of machinery and all still-life objects, portraiture, instantaneous views and dimly-lighted interiors.

The Tropical plates mentioned in these pages are particularly useful in hot climates, for they can be developed in water at *any* temperature and may be dried by artificial heat, qualities not possessed by the other brands of plates.

MEMORANDUM.—In handling plates always take them by the edges, and do not allow the fingers to touch the sensitive surface. As a general rule do not allow *any object* to come in

contact with it, as mere pressure produces an effect which is brought out by the developer, and may injuriously affect the negatives. After a box of plates has been opened, and for the purpose of avoiding the inconvenience of again wrapping them in the papers in which they were packed, those not placed in the shields may be kept in the light-tight "Safety" boxes, as above, which are made expressly for the purpose.

CHAPTER IV.

Details of Development.

WE have already said that the defects of exposure may be remedied by the treatment of the plate in development. We do not mean to say that a very great under-exposure or over-exposure can be remedied, but a moderate defect one way or the other may be. In giving the formula for the developer we measure out three ounces of the solution of oxalate, one ounce of the iron, and five to ten drops of the bromide. It is the province of the oxalate solution to combine with the iron of the iron solution, forming the ferrous oxalate, which is the active developing material; and it is the province of the bromide solution to restrain the action of the ferrous oxalate upon the sensitive surface.

The formula for mixing the developer previously given is that which has been found best adapted for a properly exposed plate, but a much under-exposed plate could not be developed with the quantity of the iron solution used in that instance. So long as the negative shows light-colored portions that fail to become covered with the dark veil, which properly should be seen on the entire surface of the plate before the negative can

be considered thoroughly developed, so long must the iron solution continue to be added to the developer. In some instances it may be necessary to add all of the iron solution at first poured out.

In case the plate after using this full strength of the developer still lacks its proper character, it will be of no use to add any more of the iron solution, as it is now saturated, and the addition of the least particle more of it will cause a decomposition of the developer—a precipitate of a yellowish color being produced, which sticks to the surface of the plate like sand—and the solution will at once cease to act as a developer. It will, in fact, begin to react, and will soon redissolve the image which had already been developed. This fact shows the importance of using the oxalate solution absolutely saturated, because, in case of the necessity at any time of using a large proportion of the iron solution, the iron might be added in excess before the original ounce poured out was entirely used, and thus the developer be spoiled.

A saturated solution of any salt is obtained when more of the soluble salt is placed in the water than will dissolve, in which case the excess will remain lying undissolved on the bottom of the vessel. If the water be warmed slightly a saturated solution can be more readily and surely made. Having found this plate under-exposed, and you have others which may be also, proceed otherwise. We have said that the bromide is a restrainer of the action of the oxalate of iron ; and, as there was some of the bromide solution used in that developer, try the next plate without any bromide at all, using merely the oxalate of potash and the two drams of iron.

If the development proceeds gradually, as it ought to do, all very well; but if upon the addition of more of the iron, as may become necessary, the picture seems to develope and become black too quickly, pour off the developer, add a few drops of the bromide, which will restrain the action of the developer and continue the development, and so on to the end.

It will be seen from the above that by the skillful use of the developer defects in exposure may be remedied. In some cases it may not be necessary to use the bromide at all, as, for instance, of instantaneous exposures, where the action of the light has been so short that the full strength of the developer is required. It may be here observed that the oxalate developer, after being once used, can be kept in one of Anthony's Developing Bottles and utilized repeatedly. Instructions for the use of the bottle have already been given.

Before using the oxalate of potash solution, it must be tested with the blue litmus paper. If the paper turns slightly red, it shows that the solution is somewhat acid, which it properly should be. If, however, the paper remains blue, it is evident that the solution is either neutral or alkaline; in that case sufficient of a solution of oxalic acid should be added to cause the litmus paper to turn slightly red. If too much oxalic acid be added it is prejudicial, for it delays the action of the developer and tends to make hard negatives.. In preparing the saturated solution of Anthony's pure protosulphate of iron, it is necessary to add to it one drop of pure sulphuric acid to each fluid ounce, immediately after it is made.

As may have been inferred from what has gone before, all

negatives are not alike, and while three persons may each take one of the same view at the same time, all may be different, yet each negative may produce a satisfactory print, although one may be better than the two others.

These differences may be caused by variations in the exposure and in the degree to which the development has been carried. A negative is, in other words, an opposite of the scene depicted as regards light, the high lights of the natural scene being represented by black in the negative and the shades by more or less transparence to light, and the deepest shadows by bare glass, through which light passes without interruption. The print made from this is called a positive, and in this the high lights and shadows appear as in nature.

All negatives that are imperfect are called either under-exposed, or over-exposed. A negative developed with too acid a developer has the same characteristics as an under-exposed one. An under-exposed negative has the blacks very dense and the half tones harsh and inharmonious; an over-exposed negative, however, is flat, *i. e.*, the high lights are not vigorous, while the half tones are nearly as strong as the high lights, and every detail is conspicuously shown in the shadows. These are usually described thus, the under-exposed as too intense, the over-exposed not intense enough; between these limits are numerous grades of negatives which produce positives more or less agreeable in proportion to their degrees of intensity.

There is another mode of development, described farther on, which gives negatives quite different in appearance from those

produced by the oxalate of iron development. It is known as the *alkaline* development.

The Alkaline Development.

The alkaline development is composed primarily of pyrogallic acid, liquid ammonia and a soluble bromide. In this case the pyrogallic acid and ammonia form the developer and the bromide acts as a restrainer or moderator of the development. Proceed as follows: make a solution of pyrogallic acid, one and a half grains to the ounce of water (No. 1), and a solution of half an ounce of liquid ammonia, sixty grains of bromide of potassium and five ounces of water (No. 2). To develope a 5 x 8 plate, pour out three fluid ounces of No. 1 and add to it fifteen drops of No. 2, and stir well together with a glass rod. As this mixture decomposes rapidly, it should be poured upon the plate as soon as possible after mixing. With this developer, as with the ferrous oxalate, the development should proceed gradually; if it progresses too rapidly the developer must be poured off, a drop or two of plain bromide solution added and again applied to the plate. In case the development proceeds too slowly, a little of the ammonia should be added. On this account it will be necessary to have at hand while developing a bottle containing a solution of bromide of potassium, twelve grains to the ounce of water, and one containing a mixture of water one ounce to two drams of liquid ammonia, by using which in turn the development may be either retarded or accelerated. Care must be taken not to use too much ammonia, as there

is danger with it of fogging the plate. The same rule as to the extent of the development must be observed as in the case of using the ferrous oxalate. All bottles containing ammonia should be kept tightly corked.

As a solution of pyrogallic acid in water does not keep long, we append a formula by means of which this difficulty may be overcome.

Edwards' Alkaline Developer.

Make two stock solutions and label them No. 1 and No. 2.

No. 1.

Pyrogallic acid,	1 ounce.
Methylated alcohol,	6 ounces.
Glycerine,	1 ounce.

Mix the glycerine and spirit, and add to the pyro—

No. 2.

Bromide of potassium,	60 grains.
Water (rain or distilled),	6 ounces.
Strong ammonia (880),	1 ounce.
Glycerine,	1 ounce.

The above will keep good, if well corked, for months.

To make the developer, add one part of No. 1 to fifteen parts of ordinary water, and label this bottle D (Developer); in another bottle mix one part of No. 2 with fifteen parts of water, and label A (Accelerator). It will be found convenient, to avoid mistakes in the imperfect light of the dark room, to

have these two bottles of different shapes. Either of the above solutions will keep two or three days, but they are best mixed fresh every day. When required to develope a plate, pour into a clean glass measure equal quantities of D and A, (say) for a half-plate one ounce of each, adding the A last, just before using; place the proposed plate face upward in a shallow dish or tray, and pour the mixture steadily over the plate, avoiding air-bubbles; should any adhere to the surface of the plate, at once remove them with the finger or a camel's-hair brush kept for the purpose; rock the dish gently, taking care to keep the plate well covered with the solution; in a few seconds the image will appear, and, if the exposure has been well timed, all the details will be out and the development complete in about one minute, when the negative should be well washed under the tap, and placed at once in the fixing bath. Do not hurry the development, but allow the plate to remain in the solution (after all the details are visible) until the required density is obtained. With these plates and the above developer there is no danger of fog except from light or over-exposure.

Equal parts of A and D give the best result with a rapid exposure, but any slight error of over-exposure may be rectified in the following manner: If on application of the mixed developer the image flashes out and the details in the shadows appear too quickly, it is an indication that the plate has been over-exposed; therefore *at once* throw off the mixed developer, and, without stopping to wash the plate, flood it with D alone, when the development will be checked, and will proceed more slowly, while the image gains in density. If too slowly, or the

negative appears to be getting too intense, add a small quantity of A (there will, however, usually be sufficient of the latter left in the plate, with the simple addition of a sufficient quantity of D) to complete development. A very little experience will enable the operator to produce a good printing negative from a plate which, if developed with the full proportion of A, would have been utterly useless from over-exposure. In very warm, bright weather it will perhaps be found an advantage with gelatino-bromide sensitive plates to use one part of A to two parts of D, giving just sufficient exposure to avoid hardness in the negative.

On the other hand, if on applying the mixed developer to the exposed plate the image appears very slowly, showing only the high lights with but little detail in the shadows, the plate has evidently been under-exposed, and more A must be added at once. This may be done by pouring the A direct into one corner of the developing tray, and rapidly mixing it with the other solution. Care must be taken not to add too much A, or push this second development too far, or the negative will be fogged in the shadows, owing to the general reduction of the silver throughout the film. If the plate be not too much under-exposed, the above treatment will be all that is required; a very much under-exposed plate will never yield a good printing negative; it is better to try again. With fairly timed exposure, and the above method of development, each plate may be depended upon to give a good printing negative, requiring no intensifying.

Anthony's Alkaline Solution for Pyrogallic Development.

No. 1. Make a solution of pyrogallic acid from one and a half to two grains per ounce of water, and to this add one grain of citric acid for every ten grains of the pyrogallic acid.

To develope, take of No. 1 the proper quantity to well cover the plate, (say) for an 8 x 5 three ounces will be sufficient; to this add half a dram of No. 2. (No. 2 is Anthony's ready-prepared alkaline solution.) Mix well and pour over the plate. If the picture does not appear readily, add carefully some more of No. 2 (about half a dram); when the negative begins to appear allow the development to proceed without adding any more of No. 2, unless absolutely necessary. This development may be varied by using different proportions of the alkaline and pyrogallic solutions. The alkaline stock solution should be kept well corked. It can be obtained in quart, pint or half-pint bottles.

A Complete Remedy for Over-Exposure.

The subject of citrates in the developer as a complete remedy for over-exposure has engrossed the attention of many eminent persons. We therefore take this opportunity of quoting the following article, by Mr. G. Watmough Webster, F. C. S., from the *British Journal Almanac* for 1883:

Everybody knows the general method of procedure when, after the application of the usual developer, the image, in-

stead of making its appearance by degrees, shows a great amount of detail almost at the moment the brightest point comes out, and the practiced hand is aware of considerable exposure having been given. The plate is instantly rinsed, fresh developer with an excessive proportion of bromide and diminished ammonia is used, and the quantity of pyro. perhaps almost doubled.

If the exposure have been fifty or a hundred per cent. in excess of what experience tells us is the correct one with the class of plate under employment the result *may* be passable; it will, after a great deal of time and trouble and an extra supply of chemicals have been spent over it, more probably be worthless. My experience was that when there was any chance of making a fresh exposure a thoroughly over-exposed plate had better be placed in the sink at once than have one minute of time spent over it, when once the fact of such over-exposure was ascertained. Nowadays, however, my views are changed.

While still holding the opinion that for the production of perfect negatives there is one exposure right and that all others are wrong, I do believe that by the use of an alkaline citrate the effects of over-exposure may be so minimized that results of an extremely satisfactory nature can be obtained, and that in cases where no amount of treatment with bromide would have given even a passable negative. This method will allow (with over-exposure so great as to be beyond the range of probability with an ordinarily practiced photographer) a negative to be obtained that would show little or no signs of over-exposure in the print from it, and little inferi-

ority over one properly exposed. I need not say that, for a restraining agent to be of any great value, its application must be practically instantaneous upon a negative that has been started to develope in the usual manner; hence, where over-exposure is feared, a more tentative mode of development than would ordinarily be employed should be practiced. For the development of a number of plates, where some doubt as to exposure may exist, but where extreme over-exposure it is felt will not have occurred, it will suffice to have the restrainer at hand ready to mix with the solution which covers the plate. Further development will then be prevented, and the usual means of procuring intensity may be resorted to. The solution I employ is made as follows—it is simple enough—

Citrate of soda, . 1 ounce. | Water, . . . 4 ounces.

For a half-plate my developing solution usually contains six minims of ammonia (I proportion the citrate to the ammonia), and about two drams of the above solution will be sufficient to counteract the effect of double or treble the correct exposure.

Perhaps the most important use of the citrate will occur when a whole series of plates are over-exposed, or when a test plate shows extreme miscalculation in that direction. If the citrate solution be added to the developer before putting the plate in the full effect will be obtained; and I am speaking within the mark in saying an almost perfect result may be obtained when four or five times the correct time has been given.

When over-timing makes itself visible unexpectedly, and it is feared that the development will have proceeded too far before the retarder can act—for it is well known that a plate goes on developing for some time after even the strongest current of water is turned upon it—an excellent plan is to throw over the surface a solution of citric acid, containing also a little chrome alum, the acid having the double effect of destroying the alkalinity and, consequently, the developing power of the developer, and of introducing into the film a small portion of the citrate of ammonia. For a minor extent of over-exposure the proportion of citrate above described will naturally be reduced.

Citrate of ammonia possesses a retarding power still greater than the soda citrate, and it is capable of counteracting a seven or eight times too great exposure. Citrate of potash I tried at first; but, without actually condemning it as inferior to the citrate of soda, I must state that its action pleased me less.

In conclusion: I should wish to say that, if any one will give this method of counteracting the effect of over-exposure by the use of a soluble citrate a trial, he will never be without a supply of the salt at hand in his developing room.

Intensifying Solutions for Gelatine Negatives.

Mercuric chloride, ...	20 grains.
Ammonium "	20 "
Water, ...	1 ounce.

Wash the negative thoroughly after fixing and apply the above until the film acquires a uniformly gray tint. Wash again and apply a very weak solution of ammonia, ten drops of the latter to one ounce of water; then wash again.

Or the following:

No. 1.

Water, ...	1 ounce.
Persulphate of uranium, ...	10 grains.

No. 2.

Water, ...	1 ounce.
Red prussiate of potash, ...	10 grains.

When the above solutions are dissolved, mix equal portions of No. 1 and 2 and flow on and off the negative until the desired density is obtained; then wash well. This gives a brownish-red color.

Roche's Intensifier.

Water, ...	10 ounces.
Sulphate of copper, ...	100 grains.
Bromide of potassium, ...	100 "

When dissolved, this solution is ready for application, and can be used repeatedly. The negative, after fixing and washing, is immersed in this solution until it bleaches or turns white.

Now remove and wash slightly, then immerse the plate in the ferrous oxalate developer, and allow it to remain until it

is black entirely through the film. This mode gives fine results and a good printing color.

Practical Notes.

Wash very thoroughly after development and fixing. The hypo. must not be used too often, as it becomes discolored and will stain the clear parts of the negative.

Weak and thin images are usually caused by excessive over-exposure and by removing the plate from the solution before the development is complete. An excess of the alkaline solution in the pyro. developer also tends to give negatives wanting in contrast.

After fixing a negative, wash the hypo. from your fingers before handling another plate.

Retouching and Varnishing the Negative.

Retouching may be done upon the dried and warmed film before varnishing, or the pencil may be used on the varnish in the usual way. A good, tough varnish should always be used, great care being taken that the negative is thoroughly dry throughout the whole thickness of the film before the application of the varnish, and that the latter flows well up to the edges of the plate.

Reproduced Negatives and Transparencies

May readily be produced by means of dry plates in the following manner: Place the negative to be copied with the film side in contact with a sensitive dry plate in the dark

slide of the camera, draw out the latter to its fullest extent, and expose the negative and plate for a few seconds to the light reflected through the lens from a sheet of white paper, placed at an angle a short distance *(but not in focus)* in front of the objective; in this manner the exposure can be perfectly controlled and correctly timed. It is advisable to use a small stop in the lens in order to obtain perfect definition, in case of a want of absolute contact between the surfaces of the negative and the sensitive plate. In this manner positives suitable for enlargement may be made with great facility; to reproduce negatives of the same size as the original, it is simply necessary to repeat the foregoing operation, using the positive as a *cliche.* In the case of valuable negatives, it is recommended that a good positive be invariably taken and kept in stock, for fear of injury to the original negative; or you can put a plate in contact with the negative in the printing-frame, and expose to gaslight at a distance of six or twelve inches for five or ten seconds. Use bromide in the developer—the iron developer gives the best tone.

Sometimes the plate, when developed with ferrous-oxalate, becomes covered with a yellow deposit.—This defect occurs when too large a proportion of the protosulphate solution is used with the oxalate solution. This is very likely to occur when the solution of oxalate of potash is not thoroughly saturated. In winter, the temperature of this solution should never be less than fifty degrees Fahr.

Stained Films

Are often caused by imperfect fixing, or by not sufficiently washing the plate after developing and before fixing, or by exposure to air and light before thoroughly washing, after removing the plate from the fixing bath. The plate should be fixed in the dark room, previous to exposure to actinic light.

Fogged Negatives

Are the result of excessive over-exposure, or the plates having been exposed in some way to the action of light, either by the use of too much light in the dark room, or by leakage of light in the camera or dark slides. A peculiar kind of fog, yellowness or stain in the shadows, is sometimes caused by the use of too much ammonia, or an insufficient quantity of bromide in the developer.

Frilling.

By this term is meant the action which occurs in the development of all plates (except the Tropical) when the water or temperature is too warm, and is shown by the wrinkling of the gelatine film all around the borders of the plate. This can be prevented by using Anthony's Anti-frill, as directed by the label on the bottle, or it can be partially prevented by immersing for a few minutes in the alum bath before fixing :

Alum, . . . 1 ounce. | Water, . . 16 ounces.

Care should be taken to keep the finished negatives in a thoroughly dry place; with this precaution they may be depended upon as absolutely permanent.

Clearing Solution for Stained Gelatine Negatives.

Alum, ...	2 ounces.
Citric acid, ...	1 ounce.
Water, ...	10 ounces.

After fixing and washing, immerse the negative from three to five minutes in this solution. On removal wash well.

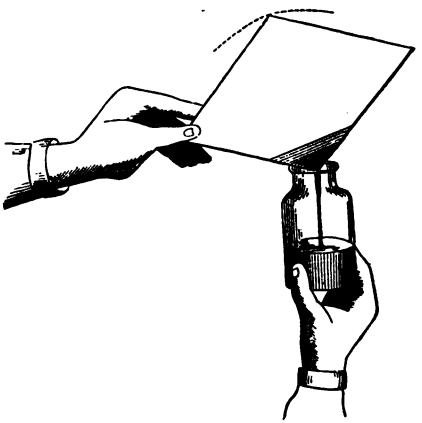
To remove the last trace of hypo. from the film, immerse a few minutes in the following solution and again wash:

Water, ...	16 ounces.
Saturated solution of acetate of lead, . .	10 drops.

Varnishing.

Ordinarily with gelatino-bromide dry plates, unless a great many proofs are required, varnishing is unnecessary; but, if it is desired, warm the plate slightly, and (after it has become perfectly dry) hold it in the left hand by one corner between the thumb and forefinger, and pour the varnish on the right-hand upper part of the plate so that it spreads to the edge of the glass in that corner. Tilt it slightly, so that the varnish will flow to the left-hand upper corner; then bring it down close to the thumb, thence to the right-hand lower corner,

and drain it into the bottle, rocking it edgewise to and fro while doing so. This motion prevents its drying in streaks



or ridges. Set it away to dry where no dust will fall on it.

Chemicals.

The quality of the articles used is a most important item. Purchase only those prepared expressly for the purpose, and as they are inexpensive, be sure and have a full supply of everything. Sufficient quantities for many plates can be carried in a small space, with the graduates and funnels necessary for mixing.

CHAPTER V.

Paper Positives.

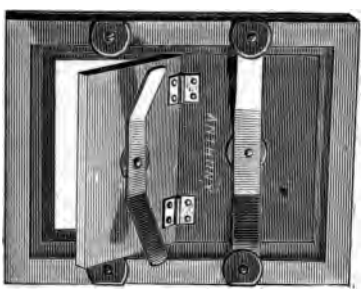
AFTER having made the negative, the next step is to produce the positive, or print on paper, which now more clearly reveals to the novice the hidden beauties of his negative. These are obtained by exposing to the light a piece of sensitized paper, pressed closely against the film of the negative, allowing no light other than that passing through the negative to act upon the paper. This action in photography is called printing, and the resulting picture a positive. As the negative reverses everything, the positive on the contrary restores the subject to its natural position. The paper used is generally one that has been coated with albumen, as this gives a smooth surface, and reproduces the finest lines in the negative. Paper, when used without such coating, gives a coarser, less pleasing result. Before prints can be made on albumenized paper it must be sensitized with the salts of silver; but as this article is supplied all ready for use, we will not go into the details of its preparation. We advise, therefore, the amateur to leave it for future experiment.

The sensitized albumen paper is, of course, sensitive to the action of light, *i. e.*, if exposed to strong light it will change color and gradually darken, if such exposure be continued, until eventually it would become black. By interposing the negative between the light and the paper the different gradations of light and shade are printed on the paper, but reversed, as compared with the negative. The transparent parts in the negative become the dark parts in the resulting positive; and if there should be spots or places in the negative so dense that no light could be seen when held up and looked through, such places or spots would prevent the light from acting on the sensitized paper, and they would remain perfectly white in the positive wherever they might occur; the less opaque places would print stronger or lighter according to their density or opacity. The sensitized paper should therefore be kept well secured from light at all times before and after printing, until the print is fixed. Full directions for these operations are given further on, and accompany each lot of the paper. While the dry plates during manipulation can be exposed only in ruby light, the sensitized albumen paper can be used by yellow or orange light. Moderate lamp or gaslight will not affect it, unless exposed too long to their influence.

Printing-Frame.

This is made for the purpose of printing by light through the negative upon the sensitized paper. It is an oblong frame, with a ledge on the inside, and a hinged door fitting

into and occupying all the back, each door having a spring rivetted to it. These springs reach across the back, and by pressing down the ends and turning them until the ends of



the springs catch under the buttons on the edge of the frame, the doors are held securely in place, and press the sensitized paper firmly against the film of the negative while being printed. As the print has to be examined from time to time, to ascertain whether it has been sufficiently exposed to the igh, by loosening one spring only one of the doors can be opened and the print raised and examined. These printing-frames are made to fit all sizes of plates ordinarily used for making negatives upon; and although a large frame can be used for small negatives by first placing in it a piece of clean, clear glass that just fits, and then the negative on this glass, we recommend every one to use frames of the exact size of the negative, as few of them are required and they are quite inexpensive.

A notable improvement in our printing-frame consists in interposing a brass washer between the spring and the hinged door, which prevents the chafing of the wood-work, that would otherwise ensue.

Keeping the Sensitized Paper.

Where but one size of plate is used, it is advisable to cut

the paper at once to that size, or one-eighth of an inch smaller, laying the pieces carefully together, and keeping them flat and well wrapped in the orange or yellow paper in which the sensitized paper is rolled.

Printing.

Lay the printing-frame on the table face downward. Remove the back and lay the negative in the frame with film side uppermost. On the negative place a piece of the paper, with the sensitized surface towards the negative film. Then lay several thicknesses of newspaper behind the paper, replace the back and fasten it down by the springs. Now put the printing-frame in the sun and print until the white parts of the print begin to show a slight discoloration. This can be seen by opening one-half the back and examining the print from time to time. After all the prints have been made, soak them for ten minutes in—

Water,	6 ounces.
Solution B,	1-3 ounce.

They are now ready for the

Toning.

The toning bath is made up of—

Water,	5 ounces.
Solution A,	1 ounce.
" B,	1 "
" C,	1 "
" D,	½ "

(Add solution A just before you wish to use the toning bath.)

Test this with the blue litmus paper. If the paper turns red, add solution B until it returns to its blue color. Warm the toning bath sufficiently to feel slightly tepid. Immerse the prints until they assume a rich, warm color, as desired, or become of a bluish tone. Then wash them in one change of water and immerse in a solution as follows:

Fixing Bath.

Water, ...	8 ounces.
Hypo. soda, ...	1 ounce.

They will first assume a reddish-brown color; but keep them in the solution until they resume the original tone, which will be lighter than when they left the toning bath.

The prints must then be washed in several changes of water to perfectly eliminate the hyposulphite of soda from the paper. If any remains, it will cause fading and yellow spots. Then dry and mount.

Caution.

The sensitized paper must be kept in a dark place. Cutting can be done in a weak light, by candle or gas. All can be cut the desired size at once and stored in a dark box until wanted. After the print is made and removed from the printing-frame, put it in the dark box until it is required for toning, which can be done when a batch is ready.

In removing prints from the toning bath put them in a

dish of clean water as finished, and when all are toned, wash in one change of water. Now place the dish containing the toned prints on the right hand, and the fixing bath, composed of hyposulphite of soda and water, on the left. Raise a print from the water with the right hand, transfer it to the left hand, and immerse it in the fixing bath. Continue thus until all have been transferred, and place the empty dish where it cannot possibly receive a trace of the hyposulphite of soda.

Use the same dishes for the same solutions at all times, and never change them. More failures result from carelessness in carrying the hyposulphite of soda into the various dishes than from all other causes.

The solutions may be purchased ready made, as follows, though we advise all to procure the proper chemicals and mix them for themselves.

Solution A is composed of water, 7½ ounces; chloride of gold, 15 grains.

Solution B is composed of water, 8 ounces; bicarbonate of soda, 1 ounce.

Solution C is composed of water, 8 ounces; acetate of soda, 400 grains.

Solution D is composed of water, 4 ounces; chloride of sodium, 160 grains.

Anthony's Patent Rapid Printing Paper.

As this paper possesses all the sensitiveness of the gelatine dry plate, it must always be used in a room free from actinic

light, and prints can be made upon it very quickly by means of ordinary gaslight. Consequently printing can be done at night, if desired, and even in the daytime artificial light alone should be used in making prints upon it. It is placed in a printing-frame, in the same manner as the sensitized albumen paper, and an exposure of five to ten seconds to the light of an ordinary single gas burner at the distance of one foot will be sufficient to make the impression. This has to be developed in the same manner as a gelatine negative. Previous to the development lay the paper in a dish of clean water for a short time, and then transfer it to the developing tray. Pour over it the following developer, for a print 6½ x 8½ inches:

Saturated solution of oxalate of potash, . .	3 ounces.
Saturated solution of Anthony's pure proto-sulphate of iron, ...	½ ounce.
Bromide solution, (12 grains of bromide of potash to 1 ounce of water), ...	¼ dram.
Saturated solution of tartaric acid, . . .	2 drops.

This developer can be used several times successively, but it should not be after it becomes turbid. Care must be taken not to develope too long, as the resulting print in such case becomes too dark. It is better to keep a stock of the saturated solution of photosulphate of iron always on hand. To prevent oxidation, it is necessary to add to a pint of the above one dram of a saturated solution of tartaric acid. This we find to give better results than sulphuric acid, which is therefore dispensed with.

Wash the prints well after developing and fix them in a bath of—

Hyposulphite of soda, ...	1 ounce.
Water, ...	8 ounces.

The fixing will require from three to ten minutes; then wash and pass through a solution of common alum one ounce, water six ounces; wash again and dry.

Care must be taken that no chemical substance, such as nitrate of silver or hyposulphite of soda, cling to the hands when using the paper—to neutralize nitrate of silver, if any should be on the hands, wash them in a weak solution of salt; the hyposulphite can similarly be rendered harmless by washing in a weak solution of any acid.

The same precautions as to the relative proportions of the oxalate solution and that of iron are to be observed as pointed out in the directions for the development of the plates.

The rapid printing paper is admirably adapted for enlargements, and takes the crayons or colors with great ease.

Notes.—The sensitive side of paper is *rolled in.*

Bromide in the developer gives more contrast.

The slightest trace of nitrate of silver or hypo. on the fingers (when handling the paper previous to exposure), will cause stains.

A discolored fixing bath, from continual use, will not give pure whites.

Develope for all the details, *but* do not carry the development too far, if brilliant results are desired. More iron can

be added to the developer, if required; but it must not exceed one ounce of iron to three of the oxalate of potash. The addition of a little citric or tartaric acid increases the brilliancy of the tints. The paper is prepared only by ourselves.

The Ferro-prussiate Process of Printing.

Paper for this process is very easily prepared, as follows: Make two solutions.

1. Water, ... 2 ounces.
   Red prussiate of potash, ... 120 grains.
2. Water, ... 2 ounces.
   Ammonia citrate of iron, ... 140 grains.

Dissolve and mix together and filter into a clean bottle. The combined solution should be kept and only applied in the dark room. To be used, it must be poured into a dish, and the paper laid down evenly upon its surface and left until it lies flat without curling, It is then hung up to dry, when it can be used immediately, or it may be kept by rolling up and placing in a tin box, with a cover, to keep out light and moisture.

To make a print on this paper, place the prepared surface in contact with the negative in a printing-frame, as usual, and expose to sunlight. As the strength of the light and the density of negatives vary, there can be no definite time given for the duration of the printing operation. The rule is to allow the light to act sufficiently long to change the portions which first print blue to a gray, with a slight metallic lustre.

At this point arrest the printing and put the print in clean water. It now gradually becomes a rich blue throughout, except in the parts which should remain white. Now change the water from time to time until there remains no discoloration in the whites; dry, and the picture requires no further treatment.

To Remove Skies.

Sometimes this is desired, on account of imperfections or stains, or even to make them appear whiter and more brilliant than they would in the plain print. To do this, make a print on a piece of sensitized albumen paper; and, without toning it, cut out with a pair of scissors all but the sky. This latter part can be laid in the sun, where it will soon become black and perfectly opaque. Fasten this against the film close to the outer edge of the negative by a little mucilage, adjusting it very carefully in the same position as when printed, and make a print from the negative with the paper covering the sky.

Clouds.

Sometimes there may be a cloud in one negative that it is desirable to put in another. This can be done by printing all but the sky, as last noted, and covering up the subject in the print in the same manner as you did the sky in the negative, printing the cloud part only. Some persons photograph the sky alone, when fine cloud effects can be had, and use the negatives solely for that purpose.

Trimming the Prints.

After the prints are thoroughly dry, they are cut to the desired size and shape, patterns for which, made of thick plate glass with beveled edges, are specially prepared for the purpose. Laying the print on a sheet of glass, face upward, place the glass pattern on it, covering that part of the picture you wish to mount; now press down firmly on the pattern and run a sharp knife all around it, cutting through the print close to the edge of the pattern.

Mounting.

As the prints naturally roll and curl, in order to mount easily place them in a basin of water, allowing them to remain until all become quite flat. Now lay them on a sheet of clean paper, face downward, and remove the excess of moisture with a piece of blotting-paper; cover smoothly and evenly with a flat brush, using gum royal or starch (preferably the former). Seize the print by opposite corners, turn it face uppermost, and lower it gently on the cardboard, allowing the lower, central part to touch first; then gradually let it down on the card, taking care to have it come in proper position; lay a piece of clean, smooth paper on it and rub well, to push to the edges any bubbles of air that may have come between the print and the card. A circular motion of the hand, beginning at the centre and finishing at the edges, is best; then lay the mounted prints away until dry, after which they can be smoothed down with a warm flat iron.

Gum for Mounting.

Starch will answer the purpose, but as this must be always used fresh, we supply an article called "Pearl Paste," which never sours or molds and is always ready. It comes in quart and pint bottles, and is very useful in any household for many purposes outside of photography. Nothing approaches it for the purpose intended. A print mounted with it can readily be removed from the card by soaking in water.

CHAPTER VI.

Taking Portraits, Groups and Instantaneous Pictures.

AS amateurs generally may not have a skylight such as is used by photographers and yet find great pleasure in taking pictures of their families and friends, besides all their household surroundings, they must have recourse to a room with a window giving a strong side light, or else make the negatives out of doors. In the former case the effect of the strong side lights must be counterbalanced by white screens, so placed as to reflect light upon the side of the sitter opposite the window, and the largest diaphragm in the lens used that may be found to include sufficient depth and field.

Out of doors the sitter should never be placed in direct sunlight—always in the shade, with, if possible, a background of shrubs, or flowers, etc. In this case, also, the largest opening compatible with depth and field should be used for the purpose of giving a short exposure.

In this connection it seems proper to introduce the consideration of *instantaneous pictures*, the taking of which will be found by the amateur to have a peculiar charm. To make

these effectually, it is necessary to have a Dallmeyer Rapid Rectilinear Lens, a drop shutter for giving very short exposures, and the very quickest of plates (Stanley's).

The drop as generally made consists of two thin pieces of wood, each having a hole cut into it of the same size, and so

arranged that when one piece is placed upon the end of the tube (which fits into the circular opening,) the other piece can be made to slide up and down directly against it. In thus sliding up and down, the orifice in the latter piece will pass in front of that of the former, and in its passage the light from the outside will enter the lens. Necessarily the quicker the movement of one opening past the other, the shorter the exposure. If, then, the outer piece is fixed so as to slide in grooves which will confine it to a vertical movement, it may be allowed to drop, and the two holes made to pass each other very rapidly. These are made by E. & H. T. Anthony & Co. to fit lenses of different sizes. For these pictures the alkaline development is best.

When the camera and drop are ready, the drop is held in place by a little detent. As the object to be taken approaches the direction in which the lens points, loose the detent and the slide drops, making an exposure of about one-twentieth part of a second. Great care must be taken not to jar the camera.

With the Stanley Dry Plates and a good strong light, it is not necessary to use the diaphragm with the largest opening. The drop described above is the simplest, but a

great many other mechanical contrivances for exceedingly short exposures are in use.

In all cases in taking outdoor views be careful not to allow direct sunlight to fall upon the lens.

What is called the *focus* of a lens may be stated in general terms as the distance between the back lens and the ground glass when adjusted sharply for a distant object. In comparing the working of different lenses, it is always necessary to know the comparative size of the opening by which the picture was made. This is given in terms of the focal distance —thus a picture taken with a diaphragm or opening whose diameter is one-twentieth part of the focal length is described as f_{20}, and so for other openings.

Beginners, in taking well-lit landscapes, are apt to over-expose; in taking dark interiors to under-expose.

Note.—The plates when placed in the shield should be carefully dusted by means of a camel's-hair blender, which should never be allowed to touch the hand or any other surface but that of the plate.

Stereoscopic Pictures.

Negatives for stereoscopic pictures are generally made with the camera prepared for a 5 x 8 plate, and fitted with two lenses of equal focal length. They can be made, however, with the 4 x 5 or 3¼ x 4¼ inch plate by taking two successive pictures of the same scene or object—the only precaution necessary

being to secure the two pictures from two points a little removed from each other. This distance may vary from three inches to as many feet, but ordinarily from three to four inches is sufficient. In taking these two pictures the same object should be brought into the exact center of the plate.

After printing, the stereoscopic picture must be properly cut for mounting. Each half of it should be about two and three-quarter inches horizontally by three vertically. Glass forms of the exact size can be obtained which, when properly applied to the print, will determine the outlines of the picture. To do this, proceed as follows:

First select the same point in each half of the print which shall be considered its centre; from this point in the right hand picture measure to the right one and a quarter inches, and make a mark; through this mark draw a vertical line, which determines the boundary of your picture on the right hand of the centre. Do the same on the other picture, only measuring one and a quarter inches to the left, and mark it; through this point draw a line parallel to the vertical line already fixed on the right side—this will form the boundary of the left hand side of the print. Now select some point near the bottom of the print; place the cutting form with one side upon the vertical line, and the bottom of the form passing through this latter point; the form now is in position to be used for cutting out one-half of the picture. Having cut around this with a sharp knife, move the form to the other half of the print, one side being laid upon the vertical line on that side, and the bottom of the form being adjusted so as to pass through the same point near the bottom of the print, as

before; now cut out this half, and you will have the two halves of the stereoscopic picture in a shape to mount.

In mounting, place the half of the print which was originally upon the right hand to the left, and *vice versa*, bringing the edges together and the bottom lines coincident. To be sure of always mounting the prints properly, always mark the back of one of the halves so as to indicate whether it is to be placed on the right or left hand when mounted. This is the proper way to proceed, if the camera should not have been perfectly level. If, however, the instrument had been level when the negative was taken, a line drawn across the entire print between two similar points can be used as a base line, and the forms can be placed upon that, the vertical sides passing through the points decided on as the right and left boundaries of the picture.

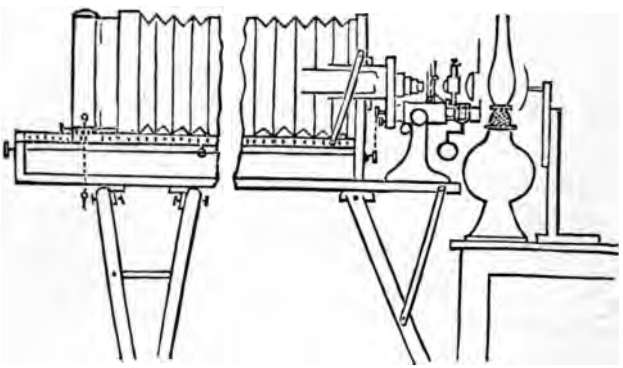
It is a bad plan to scratch lines upon the negative, as they prevent it from being used for any other purpose than making stereoscopic prints. In making transparencies, frequently one desires to get the entire half of a 5 x 8 negative, so as to show in the lantern; to do this the negative must be copied down in the camera, and any lines upon the negative would then show. Sometimes it may be desired to make single prints, mounted on cardboard with a margin all around; in such case the size of the print would be limited by any scratch that might be on the negative.

In developing the negatives made by the small camera, both should be developed at the same time, in order to have them equal in printing quality.

A correctly timed plate always yields the finest results, but

by following the instructions given below a considerable latitude in the exposure may be secured. Thus, supposing for a portrait in a moderately lighted studio three seconds to be the proper exposure, the plate may be exposed five, or even six seconds, and still give an excellent printing negative.

CHAPTER VII.



A Photo-micrographic Camera.

Believing that the photo-micrographic camera may prove to be a fruitful source of pleasure to the amateur, we have taken the liberty of selecting the following excellent article on the subject by R. L. Maddox, M. D., one of the distinguished contributors to the *British Journal Almanac* for 1883:

I am occasionally asked to afford information on the arrangement I usually employ in photo-micrography. The figure will supply a general idea to the ordinary reader, while

the details are intended only for those who may want to utilize their long winter evenings by the pursuit of this branch of photography.

The arrangement usually employed consists of a stout base-board of any suitable length—five or six feet—supported on three strong double triangle legs with an extra brace at the front end, which supports a heavy microscope, the foot-board of which is kept central by two guides fixed on the base-board at that end. Upon the base-board is raised a smaller base-board, which supports the camera, and on which it can be fixed by a pin at any of the pierced half-inch divisions for the purpose of solidity and registration. The camera is kept central by two brass guides fixed to it, which run easily along the sides of the top base-board. At the front end the short base-board is solidly fixed, by screws and a brace on each side, to a stout upright, blackened on each side, of the height of the camera employed, and to it is fastened the front of the bellows. The other end of the bellows is attached to the camera proper. The upright is pierced by an aperture to receive a short body tube of the microscope in use, and made light-tight by a thick cloth collar, which slides on the microscopic tube. A short tube is adopted simply not to lessen the field too much when the camera is fully drawn out.

A long metal focussing rod is hung through an eye screwed beneath the upper base-board in the centre of its length, and works through two apertures in the woodwork, but projects at the front end, which is provided with a pulley. Over the pulley is passed a silk braid band, which gears into the

groove of the head of the fine adjustment. The metal rod runs easily through the holes, and at the front end readily admits of the little silk band being thrown into or out of gearing. The bull's-eye condenser is attached to its ordinary rod and foot, and rests, with the lamp and reflector, upon a stout table in a line with the centre of the camera.

The purpose of the second base-board is to raise the camera to a more convenient height to protect the focussing rod, and to supply between it and the base-board a convenient space for working the focussing rod and resting diaphragms, focussing glass, etc., etc. A pierced diaphragm, blackened, is placed between the lamp and the bull's eye, and another in the camera, a little in front of the sensitized plate, with an aperture for the shape and size of the negative.

In use the object is examined and selected in the microscope in the ordinary way, using the draw tube to bring it to the average length. The eye-piece is then removed and the draw tube closed. The camera stand is brought to the edge of the table, the legs are spread, and the base-board tried by a level. The lamp is lighted, the reflector is raised to the exact height required, the microscope foot is slid between the guides, the body tube is passed through the aperture in the upright, and the cloth collar drawn up light-tight. The silk braid band, which hangs from the fine adjustment head, is now geared to the wooden pulley of the focussing rod. The diaphragm, bull's eye, and lamp with reflector are adjusted, the image of the lamp being seen on the back surfaces of the sub-stage condenser. The camera is then shut to the distance which gives about the same size of image

as seen when examined previously by the eye-piece. It is then drawn back, the eye being kept fixed on the image on the screen, and the focussing rod, or coarse adjustment, used to correct the focus until a satisfactory magnification is found. With increase in length it may be necessary to use the screw collar adjustment of the objective, as well as to perfect the focussing by the focussing rod. Likewise, the range of the sub stage condenser may need alteration to obtain the most satisfactory illumination. The sensitized plate being placed in the slide, and sufficient time having been given to allow of expansion of the cover-glass, object, and slide, due to the heating rays, the focus being rectified, if necessary, to meet the change, the focussing screen is removed and the dark slide put in position. A blank card is rested against the sub-stage to shut off the light, the shutter of the slide is drawn up, a pause of a few seconds is made, the card is snatched away, the time noted, and the exposure given. The card is now replaced, the slide closed and removed, the glass screen reinserted and the focus re-examined, by which it will be seen if any disarrangement have occurred, either in position or focus, as often happens when the objects are mounted in fluid.

There are several additional details which I have found of use in endeavoring to photograph such minute objects as the *bacteria*. The centre of the upper plate of the stage holds a blackened diaphragm pierced with an aperture, but little larger than the front lens of the objective.

For condensers I have used an achromatic condenser, a non-corrected large-angle triple condenser, and a Kelner's eye-piece with a cap pierced by a small aperture.

The exposure, with a large single-wick paraffine lamp of thirty candles' power, and also with double-wick lamps, varies, of course, with the distances of objects from the screen; but with a one-sixteenth immersion objective and the so-called "rapid dry plates" four and a half to nine minutes have sufficed for diameters from 350 to nearly 700. Much depends on the mounting of the objects, especially if stained by aniline brown, for a trace of this left on the cover-glass considerably hinders the exposure. Allowance must also be made for any deposit upon the chimney of the lamp, when used for any period. The objects themselves are often so minute that it is impossible to obtain at once a good negative, and the medium in which they are found (which is often granular if dried upon the cover glass) sadly interferes with the most perfect definition, especially under such weak light. Dr. Koch, who has been most successful in photographing the *bacteria*, rejected dry plates, and used sunlight reflected from a heliostat and wet collodion. He obtained a photograph of that most minute filament, the *flagellum* of the *bacteria rod.* I have lately with the foregoing arrangement succeeded in photographing the uniting thread of two rods, which on separation becomes the *flagellum* for each.

The photographing of large objects is comparatively easy work. The foregoing is not put forward as the best plan, but as a convenient and ready method for use with either artificial or sunlight—in the latter an "Abraham's achromatic prism" replacing the heliostat. I ought, perhaps, not to omit stating that everything is shielded from extraneous light, even up to the edge of the sub-stage, by black velvet,

and when using the apparatus in the day time the room is darkened by a black curtain before the window. The apparatus is readily arranged for sunlight at a window with a south-west aspect.

I may state that I began a series of experiments with a small glass globe containing a solution of alum and various coloring matters, to be used instead of, or in connection with, the bull's eye; but they are as yet too incomplete for anything more than this brief notice.

Amateur's Kit for Field Work.

Camera and plate shields.
Lenses and diaphragms.
Tripod top and legs.
Tripod screw.
Instantaneous drop shutter.
Focussing cloth.
Four dishes, according to size of plate.
(Stanley's) dry plates.
Oxalate of potash.
Bromide of potassium.
Anthony's alkaline solution.
Common alum.
Weights and scales.
Memorandum book and pencil.
Some ruby paper.
A few clean pint bottles and corks.
Ruby lamp.
Two four ounce graduates.
One minim graduate.
Two half pint funnels.
Anthony's pure sulphate of iron.
Pyrogallic acid.
Hyposulphite of soda.
Strong liquid ammonia.
Dusting brush.

Plate rack and stock developing bottle.	Negative varnish.
Pearl paste and brush.	Clothes clips.
Bicarbonate of soda.	Cardboard for mounting.
Gold, etc., for toning.	Negative box or envelopes.
Blue paper.	Printing-frames.
Ready sensitized albumen paper.	Rapid printing paper.
Oxalic acid.	Filtering cotton.
Acetate of lead.	Citric acid.
Alcohol.	Blue litmus paper.
Bottle of anti-frill.	Bichloride of mercury.
	One or two small packing cases for extra chemicals.

Weights and Measures.

APOTHECARIES' WEIGHT.

SOLID MEASURE.

20 grains	=	1 scruple	=	20 grains.	
3 scruples	=	1 dram	=	60	"
8 drams	=	1 ounce	=	480	"
12 ounces	=	1 pound	=	5760	"

			Symbol.
FLUID.			
60 minims	=	1 fluid dram	f. ʒ
8 drams	=	1 ounce	f.
16 ounces	=	1 pint	O ℥
8 pints	=	1 gallon	gall.

The above weights are those usually adopted in formulæ.

All chemicals are usually sold by avoirdupois weight.

$27\frac{11}{32}$ grains	=	1 dram	=	$27\frac{11}{32}$ grains.
16 drams	=	1 ounce	=	$437\frac{1}{2}$ "
16 ounces	=	1 pound	=	7000 "

Precious metals are usually sold by

TROY WEIGHT.

24 grains	=	1 pennyweight	=	24 grains.
20 pennyweights	=	1 ounce	=	480 "
12 ounces	=	1 pound	=	5760 "

Note.—An ounce of *metallic* silver contains 480 grains, but an ounce of *nitrate* of silver contains only $437\frac{1}{2}$ grains.

French Fluid Measures.

The cubic centimètre usually represented by "c. c." is the unit of the French measurement for liquids. It contains nearly seventeen minims of water; in reality, it contains 16·896 minims. The weight of this quantity of water is one gram. Hence it will be seen that the cubic centimètre and the gram bear to each other the same relation as our dram for solids and the dram for fluids, or as the minim and the grain. The following table will prove to be sufficiently accurate for photographic purposes:

1 c. c.	=	17	minims (as near as possible).	
2 "	=	34	"	
3 "	=	51	"	
4 "	=	68	"	or 1 dram 8 minims.
5 "	=	85	"	" 1 " 25 "
6 "	=	102	"	" 1 " 42 "

7	c. c.	=	119	min.,	or	1	dram	59	minims.	
8	"	=	136	"	"	2	"	16	"	
9	"	=	153	"	"	2	"	33	"	
10	"	=	170	"	"	2	"	50	"	
20	"	=	340	"	"	5	"	40	"	
30	"	=	510	"	"	1	ounce	0	dram	30 minims.
40	"	=	680	"	"	1	"	3	"	20 "
50	"	=	850	"	"	1	"	6	"	10 "
60	"	=	1020	"	"	2	"	1	"	0 "
70	"	=	1190	"	"	2	"	3	"	50 "
80	"	=	1360	"	"	2	"	6	"	40 "
90	"	=	1530	"	"	3	"	1	"	30 "
100	"	=	1700	"	"	3	"	4	"	20 "

Conversion of French into English Weight.

Although a gram is equal to 15·4346 grains, the decimal is one which can never be used by photographers; hence in the following table it is assumed to be $15\frac{2}{3}$ grains, which is the nearest approach that can be made to *practical* accuracy:

1	gram	=	$15\frac{2}{3}$	grains.				
2	grams	=	$30\frac{1}{3}$	"				
3	"	=	$46\frac{1}{3}$	"				
4	"	=	$61\frac{2}{3}$	"	. .	or	1 dram	$1\frac{2}{3}$ grain.
5	"	=	77	"	. .	"	1 "	17 grains.
6	"	=	$92\frac{2}{3}$	"	. .	"	1 "	$32\frac{2}{3}$ "
7	"	=	$107\frac{1}{3}$	"	. .	"	1 "	$47\frac{1}{3}$ "

8	grams	=	123⅓	grains	.	or	2	drams	3⅓	grains.
9	"	=	138⅜	"	.	"	2	"	18⅜	"
10	"	=	154	"	.	"	2	"	34	"
11	"	=	169⅝	"	.	"	2	"	49⅝	"
12	"	=	185⅛	"	.	"	3	"	4⅛	"
13	"	=	200⅓	"	.	"	3	"	20⅓	"
14	"	=	215⅝	"	.	"	3	"	35⅝	"
15	"	=	231	"	.	"	3	"	51	"
16	"	=	246⅔	"	.	"	4	"	6⅔	"
17	"	=	261⅛	"	.	"	4	"	21⅛	"
18	"	=	277⅓	"	.	"	4	"	37⅓	"
19	"	=	292⅝	"	.	"	4	"	52⅝	
20	"	=	308	"	.	"	5	"	8	"
30	"	=	462	"	.	"	7	"	42	"
40	"	=	616	"	.	"	10	"	16	"
50	"	=	770	"	.	"	12	"	50	"
60	"	=	924	"	.	"	15	"	24	"
70	"	=	1078	"	.	"	17	"	58	"
80	"	=	1232	"	.	"	20	"	32	"
90	"	=	1386	"	.	"	23	"	6	"
100	"	=	1540	"	.	"	25	"	40	"

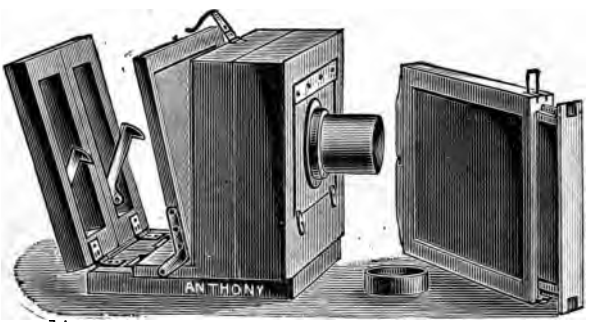
APPENDIX.

SINCE the foregoing pages were written by Mr. T. C. Roche, the world of progress has moved very rapidly, and the strides of photography have been long and with more accelerated motion than in any similar art in the same amount of time. It seems but the other day that this handy little guide for the amateur came from the press in the first of several large editions, and now we are called upon to revise the pages for a new one, and make such additions as are necessary to keep it abreast of the times. The enthusiasm developed by the practice of amateur photography has called forth a corresponding amount of ingenuity on the part of the optician and mechanic to supply the increasing need of compact apparatus and devices to secure better results in this fascinating art for the amateur. The clumsy apparatus of but a few years ago have to-day been replaced with those that exhibit such skill on the part of the mechanic and inventor, and are produced at such moderate cost, that we wonder that the amount of labor displayed in their construction allows of their being sold for so little money.

We have not space in these pages to take note of all the numerous improvements that have been made, but shall confine our attention to those of a more conspicuous character, and which can be obtained with a reasonable outlay of money.

Cameras.

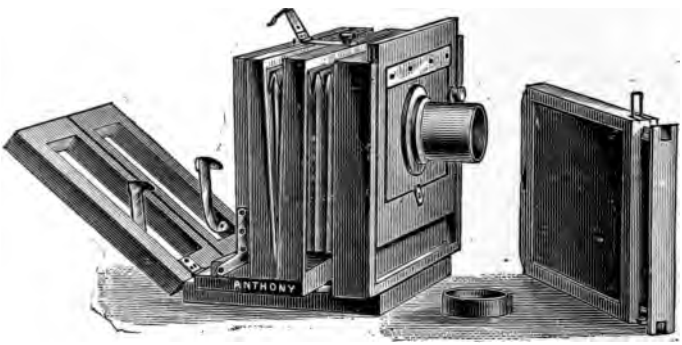
Among the cheaper outfits must be named those designated by the terms O. N. A. Outfit No. 2 A, and O. N. A. Outfit No. 2 B. We give herewith some excellent cuts of these cameras, and simply call attention to the following statements in regard to their capabilities.



EQUIPMENT NO. 2 A.

This consists of a handsomely finished camera for taking pictures 5 x 8 inches in size. It has a folding bed, that it may be packed more closely in its case for traveling; which bed is fastened in a flat position by a couple of ingenious patent hooks. The front is removable, so that the lens, which projects while in use, can be reversed and turned inside the camera in packing. The lens is one of the well known E. A. single achromatic variety for views, and is fitted with two diaphragms that can be used to suit the variations in light when taking pictures on dark or bright days. The plateholder is double, and carries two plates, while it is the smallest and lightest in the market for this purpose. The tripod is one of the neat folding

varieties and well suited to its purpose. This whole outfit (camera, lens, holder, tripod and top) weighs only ten pounds. The camera and holder, together with the tripod top, go into a neat carrying case, the tripod legs forming a separate small bundle. The whole outfit complete costs but $12.



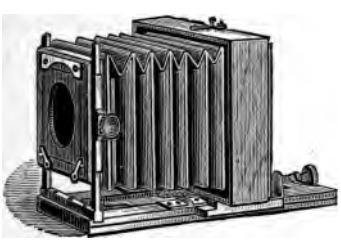
EQUIPMENT NO. 2 B.

This outfit is exactly like the former one, except that it has two additional conveniences. The first of these useful additions is a swing-back, which allows of the ground glass being inclined more or less to suit variations in the focus in different parts of the picture when the camera is not in a horizontal position. The other addition is a rising front, which enables the operator to take in more or less foreground or sky if he chooses, to make an agreeable picture. These additions add nothing to the weight of the camera and but a little to the cost, this latter outfit complete costing $15.

These outfits are certainly the cheapest good sets of apparatus, not mere toys, that have been constructed up to the present time. They are as light as is consistent with durability,

and they embrace many improvements only heretofore found upon more expensive apparatus. The thoroughly good work of the mechanic exhibited in their construction, and the remarkable work done with the lenses supplied with them, is a source of admiration to all who see them. They are certainly the best investment of his money for the beginner in photography that we know of.

Many amateur photographers, after they have overcome the early difficulties of the art, look around for pieces of apparatus that are suited to some particular kind of work. Some of them own magic lanterns and desire to make pictures with a view to preparing transparencies for projection. For such as these, or indeed, for any who wish to make small pictures, there is no better camera than the little "Bijou." We give below a cut of this neat little piece of apparatus, and can assure our readers, from personal experience, that it is the pleasantest photographic companion on a ramble that we have traveled with.



THE BIJOU CAMERA.

When folded it measures 5 x 5 x 3½ inches, and can readily be put in an ordinary hand-grip, or may even be carried in the overcoat pocket. It weighs only 14½ ounces, and the plateholders are correspondingly light and compact. It has a sliding front, hinged ground glass, and folding bed, which is provided with a novel arrangement for fixing it in position, enabling the operator to adjust it in a few seconds.

As the plates are the same size as those used with magic lanterns, slides may be made from them by contact printing in an

BICYCLE EQUIPMENT.

ordinary printing frame. By using rapid printing paper in connection with the enlarging lantern, pictures may be made

as large as desired. For tourists, to whom weight and bulk are objections, this camera is of especial value.

A slight modification of the above camera is now made to suit our friends of the wheel: we mean the bicycle riders. For their especial benefit a special clamp and other fittings have been attached to a small camera that can be readily carried on the wheeled steed. This particular outfit consists of a camera for taking pictures of the same size as the Bijou, a single achromatic lens, a double plate holder, and a brass clamp for attaching the camera to the handle-bar of the bicycle. A telescopic brass foot, to convert the bicycle into a camera stand, can be obtained if desired. This latter device is very ingenious, and is shown in use in the cut which we give below. The camera, plate holder, lens and clamp for attachment to handle-bar, all go into a neat sole leather-case, which is provided with a shoulder-strap for carrying. The weight of the complete outfit is only two pounds.

Another class of amateurs become ambitious to take large pictures, and for their especial benefit a series of cameras have been made which are constructed upon the same principles as the O. N. A. cameras we have previously mentioned. They are thoroughly well made, and, taking into consideration their size, are correspondingly as cheap as the outfits before described.

There is no end to the variety of cameras from which the amateur can make a choice as his ideas and ambitions increase; but we must not leave this part of our subject without saying a word or two about the latest craze, "The Detective Camera." The idea of having a camera that could be used while carrying it in the hand, was first entertained by William Schmid, who in-

vented an instrument for this purpose, and entirely did away with the use of a tripod and focusing cloth as necessities for photographic work. After a very little observation, it will be noticed by the amateur that he can draw out the bellows of his camera to about the same spot every time, and get very near the correct focus upon the ground glass. Furthermore, he will also notice that the difference in focus for objects a few feet off, and others a hundred feet or more, makes only a slight range in the motion of the bellows. It is therefore obvious that a camera can be made which is suited to any particular lens, and will give correct pictures of objects at varying distances by making only a slight movement of the ground glass. Again, it can readily be conceived that the focus for objects at any given distance can be fixed beforehand and the camera adjusted without the necessity of looking at the ground glass. Upon these very simple principles the Schmid Detective Camera is now constructed. The cut below gives a good idea of this neat and highly ingenious little instrument.

SCHMID DETECTIVE CAMERA.

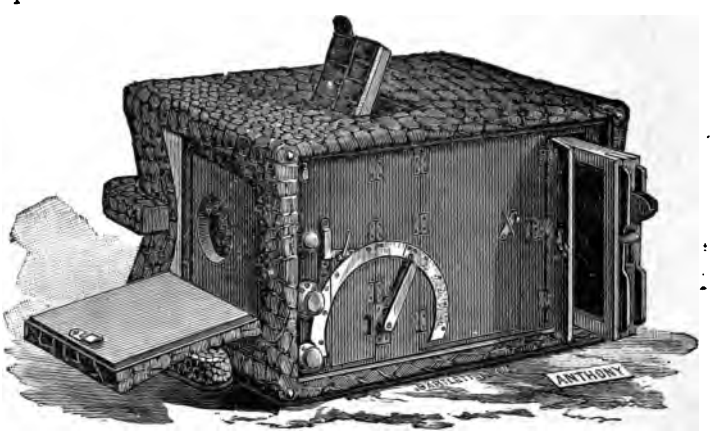
As stated above, the camera is focused for objects at various distances, and the points are marked upon the index seen

at the side of the box, in the cut, the pointer of the index serving to act upon gear work to bring the camera in adjustment for any given distance. As shown in the cut, the plate holder slips into the back end of the camera and in front of the ground glass, being held in place by stiff springs. At the front of the camera a revolving shutter is arranged that can be set at various speeds to suit almost any kind of exposure; while a little camera obscura in the upper corner serves to show the operator when the object is in range for the camera proper. This latter device is so fitted that the observer simply looks down upon a little mirror set at an angle in a square black cavity, and which receives the image formed by a small lens placed on one side of the front of the camera. When the image is seen in the right position in this little mirror, a push upon a button on the side of the box releases the shutter and the exposure is made; the slide in the plate holder having been previously drawn. Replacing the slide in the plate holder, reversing the latter, setting the shutter again, removing the slide of the holder as before, and the apparatus is ready for another shot.

Since the above detective camera was invented, many improvements have been made in the details of its construction, and the final result of these is embodied in a beautiful piece of apparatus that seems to be the climax in the development of this ingenious photographic device. We refer to the harmless-looking satchel camera recently patented by Mr. Richard A. Anthony. In outward appearance, and to the ordinary observer, this latest modification of the detective camera looks exactly like an alligator hand-satchel that is carried by a shoulder-strap

at the side of the pedestrian. Upon closer observation, one sees that it consists of an artfully-concealed detective camera, in

which all the various movements to secure a picture are situated upon the under side. For use the camera is held so that the



base of the satchel rests against the body of the operator. By means of a brass pull at the side the shutter is set. A plate in

the regular holder is placed in position at the back of the camera and the slide is drawn ready for exposure. The release

of a short catch exposes the front of the shutter ready for action, and by raising a small leather-covered lid the little camera

obscura called the finder, on the (now) upper side of the camera, shows the position that the object will occupy on the plate. The slightest touch upon a small brass button releases the shutter, and the exposure is made. Replacing the slide in the plate holder, reversing the holder, and setting the shutter again, leaves the apparatus in readiness for another shot, when the plate-holder slide is withdrawn as before.

By removing a screw that takes the place of the spring lock of an ordinary satchel, the camera proper can be removed from

its cover, and the screw removed serves to attach the camera to a tripod for ordinary use.

This last form of the detective camera allows the operator to carry with him twelve plates in the interior of the apparatus, and so carefully packed away that no light can strike them. It is also furnished with an ingenious attachment by which the speed of the shutter can be regulated to suit the speed of objects moving with greater or less velocity. While by simply releasing a catch, time exposures can be made at the will of the operator. In fact the whole affair is the latest achievement in ingenious and compact light photographic apparatus.

The utility of this combination of devices is beyond question. It has been used to catch the portraits of refractory criminals when the more formidable tripod and camera of ordinary construction would be a signal for all kinds of capers to frustrate the designs of the photographer. The tourist traveling in a strange country, where the inhabitants are jealous of foreigners, and would never let them secure pictures of curious and valuable objects, can take this innocent-looking satchel with him without exciting the least curiosity, and capture trophies not to be obtained by any other method of procedure. The use of this camera is not only instructive and entertaining, but it can readily be conceived that pictures of people in ludicrous situations makes it also a source of considerable amusement.

Tripods.

As in the case of cameras, so also with tripods, great ingenuity has been displayed in the endeavor to secure rigid stands with a minimum of weight, and at a moderate cost. A very neat modification of the telescoping tripod is now made, which is virtually a telescoping and folding tripod combined. Yet

another form of tripod is a combination of folding and telescoping movements, by which the stand is reduced to one-third of its standing length when packed for transportation. This is called the "Triplex Tripod." We give below a cut of this

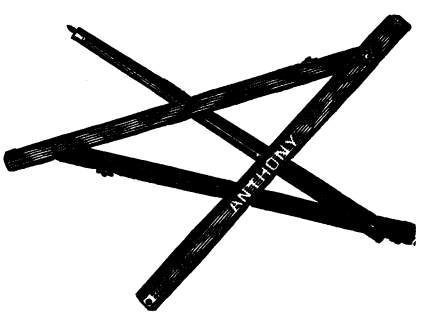
useful form of the less expensive style of these very necessary appurtenances of the photographer.

But of all the tripods ever invented, that combine at once extreme lightness with rigidity, and compactness in packing for transportation, the Fairy Tripod is unquestionably the best. We know of no stand that weighs as little as this one (1 lb. 15 oz.), and which packs into so small a space (16 inches), while at the same time it is rigid enough to carry a camera

capable of taking pictures 6½ x 8½ inches in size. The mode of constructing this stand is shown by the cuts given herewith, and which explain themselves. We can heartily recommend this stand as the best thing of the kind we have yet seen for its purpose.

Showing one leg of Fairy Tripod folded.

Showing Fairy Tripod set up ready for use.



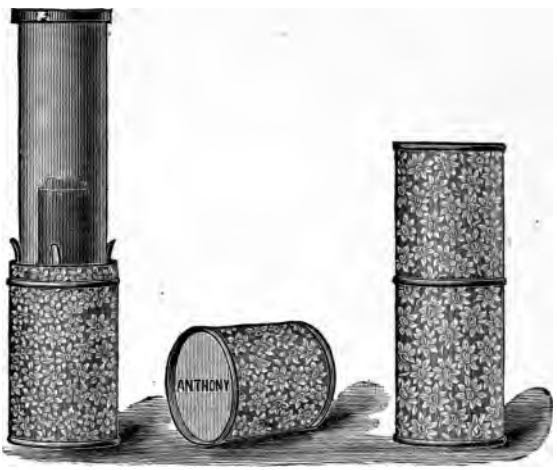
Showing one leg of Fairy Tripod partly folded.

Ruby Lamp.

We cannot take space to note a host of minor improvements that have been made in the various conveniences used in the field and dark room. But for the tourist-photographer a neat little ruby lamp recently brought out deserves some mention. This is the "Tisdell Candle Ruby Lamp," and will be found quite a comfort to those who travel around with their cameras and apparatus, and need everything packed in the minimum amount of space. Among traveling paraphernalia of various kinds, nothing is more disagreeable to carry, or more dangerous to other objects near it, than oil of any kind. Hence an oil ruby light is about the last thing one would choose for a tourist kit for photography. Many lamps that use candles instead of oil have been devised to meet the necessities of the case we have just cited, but this little lamp, invented by Mr. Tisdell, appears to meet the demands upon it quite thoroughly. The cut given below shows the general construction of the lamp.

On the left-hand side of the figure it is seen set up ready for use, while on the right it is shown packed for transit. On opening the box in which it is packed, there will be noticed a ruby chimney that fits immediately inside this outer case. This chimney, when removed and reversed, fits upon a holder that carries half of an ordinary wax candle, and which is contained in the lower half of the box. Thus the base of the box serves to hold the candle, while the ruby chimney fits just inside and falls a little below the upper edge of the box, thus preventing the escape of any light from below the ruby chimney. Upon the top of the chimney is a black Russia iron cap that shuts off any

light in that direction. As the candle burns, a spiral spring in the holder forces the light to the top of the tube. The whole



affair packs in a box $6\frac{3}{4}$ x $2\frac{1}{2}$ inches, and weighs 12 ounces. Those of our friends who need a ruby lamp for traveling, will, we think, find this one better than any oil lamp, and admirably suited to its purpose.

Development of the Exposed Plates.

The beginner in photography should carefully read the remarks upon this subject beginning on pages 17 and 46. In addition to what is there stated, we would call attention to the following:

The effect of light upon the sensitive plate is to produce a condition of the material spread upon its surface which allows of its being still further acted upon by the developer. The most careless observer will note that daylight is of very variable quality according to the conditions of the atmosphere. Bright sunshine makes objects stand out clearer, and for greater distances than the light of a cloudy day. It will also be remembered that the light of noon is more powerful than that of early morning or evening; and the same is true of summer and winter. Furthermore it must be noted that a landscape with snow upon the ground is brighter than one that is bare. Now, all these conditions of the light must be taken into consideration when making the exposure of the gelatine dry plates to obtain a negative, as they determine the character of the treatment of the plate during development. On page 15 will be found some very pertinent remarks about the management of diaphragms in lenses to control the amount of light falling upon a plate, and we cannot do more than refer to them at this point and add one word of caution. Since those lines were written, the manufacture of dry plates has been so much improved, that they are generally much more rapid than those spoken of, and the time of exposure must be made very much shorter. With bright sunlight and a quarter inch diaphragm

in the lens, we should not recommend an exposure of more than *one second* for the Stanley Dry Plates. If the objects to be photographed are upon the water, this time should be reduced, or a smaller diaphragm should be placed in the lens.

Nothing but a few experiments with a given brand of plates will teach one how to use them. It is folly to set down any hard-and-fast rule for all kinds of plates. During the time of the experiments on exposure, great care should be taken to form a judgment of the quality of the light and its mode of falling on the subject, as seen on the ground glass of the camera.

Having determined the right exposure for the given brand of plates in use, the development is moderately simple. With the most careful judgment as to light, there is one thing that will often happen, that is, over-exposure. With this possible contingency in mind, we proceed to develop a plate somewhat in the following manner:

Into one dish pour the mixture of the developer in the proportions given upon the formula that accompanies the brand of plates in use. These formulas are generally about right, that is, those made with either soda or potash carbonates as the alkali. The soda developer is less likely to frill the plates than that made with potash, but the latter will often bring out detail not obtained with the former. In making up a potash developer from a soda formula, it requires one-third more potassium carbonate to make it equivalent to the amount of sodium carbonate given. In addition to the regular formula, which should contain only a little bromide of potassium (say 1 grain in 4 ounces), make up another bath in the same manner as the first, but with more bromide (2 grains to the ounce), and place

the dish alongside of the first one made up. The plate is first placed in the normal developer and its progress watched. If the development begins in about one minute and only the high lights come out, continue the development until all the detail in the shadows appears. Then wash the plate pretty thoroughly in running water, and place in a bath of alum and citric acid, to remove stains. (See page 62.) In this development take care that the high lights do not begin to fog, for if they do the negative will lack brilliancy. If the detail will not come out without fogging the high lights, the development may be continued a little longer, but the result will be a poor negative, for the plate that shows this characteristic is under-exposed, and we think but poorly repays any time spent upon it in development. It may be improved by intensification, but not by further development.

If, on the other hand, in placing the plate in the normal developer, the image appears quickly and contains considerable detail within one minute after putting it in the bath, remove it at once and place it in the developer containing most bromide. The image obtained quickly in the normal developer will be thin, and by placing it in the bromide developer and allowing it to remain there it will gradually becomes more dense, and in ten or fifteen minutes a good negative will be obtained.

Having given a general idea of the method of development as now practiced with rapid dry plates, we will add a few formulas for making up developers.

Beach Potash Developer.

No. 1.—*Pyro Solution.*

Warm distilled or melted ice water,	4 ounces.
Sulphite of soda (crystals, chemically pure, 437 grains to the ounce),	4 "
When cool, at a temperature of 70 degrees, add	
*Sulphurous acid,	3¼ "
Pyrogallol (1 commercial ounce),	437 grains.

The concentrated solution will measure 9¼ fluid ounces and be a 10 per cent. solution. 6 grains of pyro to each dram.

No. 2.—*Potash Solution* (made of two solutions).

A.

Warm water,	4 ounces.
Sulphite of soda (crystals, chemically pure, 437 grains to the ounce),	2 "

B.

Water,	4½ "
Carbonate of potash (chemically pure, 437 grains to the ounce),	3 "

A and B are mixed and the combined solution, measuring 10 ounces, is ready for use. One dram contains about 16 grains of potash.

For use take one dram of No. 1 and one dram of No. 2 to three ounces of water; with half a dram of solution of bromide potassium (12 grains to the ounce). If the plate is over-exposed and develops too rapidly, remove it, wash slightly and

*Instead of using sulphurous acid you can add sulphuric acid to the solution of the sulphite of soda until it smells strongly of sulphurous acid gas, and finally make up to 9¼ ounces with water.

put it into another developer made up the same as the above, with the addition of three drams of the bromide solution; this will retard development and give density to the negative.

Cooper's Soda Developer.

No. 1.

Sodium sulphite crystals,	1 pound.
Distilled water,	2 quarts.
Pyrogallic acid,	2 ounces.

No. 2.

Carbonate of soda, crystallized,	½ pound.
Water,	2 quarts.

To develop, use two ounces of each, No. 1 and No. 2, with two ounces of water. Restrain with bromide as in the Beach developer, if necessary. For rapid exposures Mr. Cooper recommends to place the plate in a bath of carbonate of soda (crystallized) 1 ounce, water 10 ounces, for about half a minute before the regular developer is poured upon it.

The last developer is now sold already mixed in the proper proportions for development and in a concentrated form; it is only necessary to add water to it for use. For those who do not want the trouble of making up developers, this is a great boon.

Still another improvement is the new developer of two solutions, which can be used repeatedly. In this case you can develop a plate and return the developer to the bottle to be used again on another plate, and the solution will last a very long time. One solution contains the pyro developer and the other is used to bring out detail when the first fails to do it. This

last developer is sold ready prepared and is exceedingly convenient.

It is generally a safe plan, after developing, to wash the plate well in running water, and then place it in the alum bath given on page 62, and wash again before placing it in the hypo solution to fix it.

The Ferrous Oxalate Developer.

The following formula has been found to be an improvement upon that given on page 18.

First make two stock solutions as follows:

No. 1.

A saturated solution of oxalate of potash, and test with blue litmus paper; if it *does not show* an acid reaction, dissolve a little oxalic acid in water and add enough to the solution to cause the blue test paper to turn red.

This solution should be filtered before use.

No. 2.

Make a saturated solution of *pure* sulphate of iron, and to one quart add three or five drops of sulphuric acid, to prevent oxidation, and filter.

To develop a 5 x 8 plate, take three ounces of No. 1, and to this add ¼ dram of bromide of potassium solution (which is, water, one ounce, bromide of potassium, twelve grains); then add half an ounce of No. 2. This forms the developer. Transfer the plate to a developing dish and pour on the developer. If the picture comes out gradually and develops sufficiently, it is well; but if from *under*-exposure the details hang back and refuse to develop further, then add two drams or

half an ounce more of No. 2, which will bring the picture out with full details, unless greatly under-exposed.

Never exceed one ounce of No. 2—the *iron*—to three ounces of No. 1, for if you do you will form a sandy deposit, and stop the action of the developer.

Always develop until the picture seems sunken into the surface; do not judge by looking through the negative only. Wash and fix in hypo, one ounce, water, eight to ten ounces. After fixing, wash well.

N. B.—For extremely rapid exposures dispense with the bromide in the developer. This developer can be used repeatedly.

A Word on Fixing.

One of the gravest mistakes in making negatives is to hurry the fixing. It is better to have two fixing baths and after the plate is apparently well fixed in the first, place it in the second one for some time to make sure that all the silver salts are dissolved out. When the first bath fails to fix the plates with moderate rapidity, throw it away, make a new second bath, and use the former second bath as the first one. After fixing and thoroughly washing, a short time in the alum bath before mentioned will be found beneficial, more especially if the hypo solution is somewhat discolored by use. A dirty hypo solution should be thrown away; a moderate amount of color does no harm if alum is used afterward.

Intensification of Negatives.

The production of thin negatives should be avoided if possible; but in cases where such a negative is obtained, and it is desired to strengthen it, we have found the following method among the best of quite a number which we have tried.

Make a saturated solution of corrosive sublimate (which is highly poisonous, therefore handle it with care), and mix one volume of this solution with six or eight volumes of water. Into this diluted solution place the thin negative and let it remain until the back of the film begins to appear white; that is, has a gray shade. Now remove the plate, wash slightly, and place it in a saturated solution of sulphite of soda. If the negative is only moderately thin, the sulphite solution may be used half saturated. The result is a good black negative, which should be well washed in running water. The results of this treatment are quite permanent, which is not the case with many other intensifiers. Very thin negatives may be improved by intensification, but are usually not worth the trouble.

Printing and Toning.

In addition to what has already been said upon these operations in Chapter V, we give here some further details and an improved method of toning the ready sensitized paper.

In the first place the printing frame used for the purpose of insuring perfect contact of the negative with the sensitized paper has lately been very much improved, This improved piece of apparatus is shown below. In addition to being very strong, and at the same time extremely light and compact, it is so constructed that the springs lock into the eyes or catches

on the sides, rendering it impossible for them to slip from position. This frame is a great improvement on those formerly

made, and is called the "Fairy Printing Frame" on account of its lightness.

To obtain the best results with the ready sensitized albumen paper, it should be fumed before printing upon it. In fuming suspend the paper—being careful not to have the sheets overlap each other—over a saucer containing two or three drams of liquid ammonia placed in the bottom of a paper or wooden box; cover the whole and leave for twenty minutes. If the saucer of ammonia is placed in a dish of warm water, the paper need be left only fifteen minutes. It should be printed as soon after fuming as possible.

Lay the printing frame on the table face down. Remove the back of it and lay the negative in the frame, with film side up. On the negative lay a piece of the paper, with the sensitized surface against the negative film. Then lay several thicknesses of newspaper behind the paper, replace the back and fasten it down by the springs. Now place the printing frame in the sun and print until the white places of the print begin to

show a slight discoloration. This can be seen by opening one-half the back and examining the print from time to time. After printing, soak the prints in a solution of—

Water, ...	6 ounces.
Citrate of soda, ...	20 grains.

Leave them in this solution till they assume a reddish color, then wash thoroughly in cold water. They are now ready for the toning solution. This is made with

Water, ...	6 ounces.
Solution A, Gold Chloride 15 grs Water 7½	1 ounce.
" D, Salt 160 grs Water 3iv.	1 dram.

Add solution B till the bath shows an alkaline reaction—that is till it turns red litmus paper blue.

Solution A is composed of water, 7½ ounces, chloride of gold, 15 grains.

Solution B is composed of water, 8 ounces, bicarbonate of soda, 1 ounce.

Solution D is composed of water, 4 ounces, chloride of sodium, 160 grains.

Warm the toning bath until it feels slightly tepid. Immerse the prints in it until they assume a rich, warm color, as desired, or until they become of a bluish tone. Then wash them in one change of water and immerse in the fixing solution. This consists of

Water, ...	8 ounces.
Hypo soda, ...	1 ounce.

They will first assume a reddish-brown color; but keep them in the solution until they resume the original tone, which will be lighter than when they left the toning bath.

They must then be washed in several changes of water to perfectly eliminate the hyposulphite of soda from the paper; if any remains it causes fading and yellow spots. Then dry and mount them.

Paper Negatives.

Those of our amateur friends who have mastered the difficulties involved in the use of glass negatives, are recommended to try the use of paper as a substitute. In paper negatives the gelatine emulsion is spread upon specially prepared paper instead of glass, and as a consequence is very much lighter to carry.

The negative paper thus prepared and sold by E. & H. T. Anthony & Co. is wound upon paste-board rollers that have an inwardly projecting tongue or feather, which runs in the slot in the empty spool contained in the roll holder, as the roller containing the negative paper is slid on this wooden spool.

FIG. 1.

SHOWING THE EMPTY PASTE-BOARD ROLLER ON WHICH THE NEGATIVE PAPER IS SUPPLIED.

To expose this negative paper in the camera, a holder to carry the rolls and systematically unwind them has been devised. This roll holder is shown in Fig. 2.

It consists of a light-tight case, with a slide as in an ordinary plate holder, and within the case there are two rollers and a flat table over which the paper is stretched. One of the rollers

is an empty spool for sensitized negative paper and the other is destined to receive the paper after being exposed. In Fig.

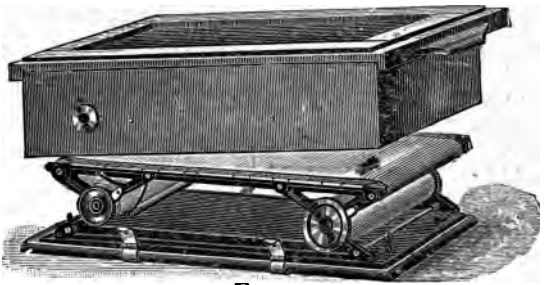


FIG. 2.

3 is shown the method of inserting the spool of paper, which

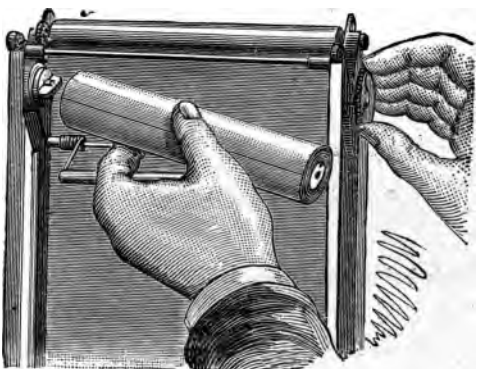


FIG. 3.

is afterwards stretched over the flat table, as seen in Fig. 4, and then fastened to the receiving roller on the opposite side of the case. By a very ingenious piece of mechanism the paper is wound on to the receiving roll, and when four clicks are heard, an index upon the outside of the box indicates when a new surface has replaced the one that has been exposed. Af-

ter making any desired number of exposures the roll holder is taken to the dark room, and, upon opening it, there will be found that the paper has been marked at the extreme edge with four little perforations for every exposure made; that is, one perforation at every quarter of the length of the exposed surface. By this means the various exposures can be counted off and the paper cut in pieces, as indicated in Fig. 4, where the last ex-

FIG. 4.

posure made is being cut from the spool of unexposed paper. The description of the operation of this roll holder is somewhat lengthy, but the use of the apparatus is simple. With this roll holder one can carry the paper for twenty-four negatives, and it will weigh only about one-fifth as much as the glass and plate holders for twelve ordinary negatives. This great gain in portability will readily recommend it to the traveling amateur.

Having made the exposures, and cut the paper into its proper lengths for each negative by the method indicated above, the next step is to develop them. And here again the paper neg-

atives have a marked advantage over glass, for you can develop half a dozen of them at the same time in one large dish, since, with a little care, they are not injured by contact with one another. The development is precisely the same as with glass plates, except that it is best to begin with a diluted developer, that the formation of the image may take place slowly and the several negatives in the bath be more readily watched. After the developing the paper negatives are fixed in hypo in the same way as glass plates, and washed in the same thorough manner, which is more easily accomplished than with the latter. After washing, the negatives while still wet are pressed, film side down, upon a plate of hand-polished hard rubber, or a plate of glass very sparingly smeared with vaseline, which has been again rubbed off. They are allowed to remain upon the plate until perfectly dry. After drying, the negatives are smeared with castor oil, and rubbed with a hot clothes iron; or, better still, are treated with a preparation called "Translucence." By this operation the paper is rendered more or less translucent and is ready for printing, which is accomplished by placing the paper negative in an ordinary printing frame with a piece of plain glass as a support.

For those who wish to try the paper negative process in ordinary plate holders, a wooden kit with a light metal frame is made that carries the paper and slides into the plate holder like an ordinary glass plate. This is shown in Fig. 5.

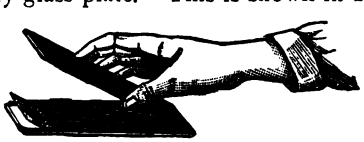


FIG. 5.

It is impossible in this place to state all the advantages of this ingenious system of making paper negatives, and we strongly recommend our readers to investigate the process if they desire to take up one of the latest developments in photographic art.